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Economic feasibility of production and export of organic cocoa in south-western Nigeria

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ECONOMIC FEASIBILITY OF PRODUCTION AND EXPORT OF ORGANIC COCOA IN SOUTH- WESTERN NIGERIA

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ABSTRACT

The increased consciousness of consumers concerning safety of what they consume as well as increased awareness about the safety of the environment have brought organic farming into the limelight. Developing countries have great potential for exploiting the organic market as there is a large market demand for organic products in the developed countries especially in Europe and America. Nigeria, one of the biggest world cocoa producers can access and exploit the organic cocoa and /or organic chocolate market. This study examined the economic feasibility of production and export of organic cocoa in south-western, Nigeria. Data were collected by a structured questionnaire and a field survey, and one hundred cocoa farmers were sampled. Conventional Nigerian cocoa farmers encountered numerous problems such as high labour cost, unavailability of labour, lack of capital, insufficient supply of agro-chemicals, price fluctuation, and pest and disease infestation. Black pod disease is the predominant cocoa disease and this is can be controlled organically by traditional practices such as farm sanitation and application of neem leaves extract, and by planting resistant varieties. Hand-weeding was found to be effective in achieving a high yield of conventional cocoa in Nigeria. This result favours organic production of cocoa in the study area. Using gross margin analysis both conventional and organic production systems were found to be profitable in Nigeria but conventional production had higher production cost, thus making organic cocoa production potentially more profitable if yields were maintained, since farmers would enjoy the double benefit of a higher revenue from the premium price and reduced production cost (total revenue of proposed organic production is 5% to 79% higher and 40% reduction in production cost as against conventional production). This study recommends that the ways in which Ghanaian organic cocoa production has been established, and the methods used for organic cocoa production and crop production, should be studied and adopted in Nigeria as these two countries are in the same agro-ecological zone and are likely to face similar challenges to organic production.

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CHAPTER ONE

1.1 Introduction

Organic farming is said to be an agricultural system that sustains and enhances health, ecology and fairness in a precautionary and responsible manner (IFOAM 2007). The growing consciousness and awareness about health, safety and environment by consumers have influenced the consumption of, and demand for, organic products due to the belief that organic products not only satisfy safety and environmental issues but also have better qualities than conventional products in terms of taste, colour, freshness and nutritive value (Bourn and Prescott 2002). As a result of this increased demand for organic products, organic farming is found to be one of the fastest growing agricultural production systems in the world today. Organic agriculture accounts for 1% of the total world agriculture (IFOAM 2007). It has been found to be a promising commercial agricultural system in about 120 countries of the world having a market value of \$40 billion in 2006 and expected to rise to \$70 billion by 2012 (ICCO 2006). Organic products include processed vegetables, cereals, root crops and fruits dried fruits and nuts, spices, meats, eggs, cash crops such as coffee, tea and cocoa, and dairy products which are sold in the global markets. Fruit and vegetables are typically the largest category of organic products, accounting for 30-40% share of the market and estimated at \$9 billion (UNCTAD 2004). However, non-certified organic agriculture is being practised more in the developing countries. Organic farms in developing countries, particularly in Africa, produce non-certified organic crops for self sufficiency and local markets (Chubb *et al.* 2005). Likewise, Rai (2005) concluded that the growing interest in organic agriculture in the developing countries is as a result of availability and great reliance on the natural and

human resources, which require lower cost inputs and provide safe food alongside conservation of the environment.

However, UNCTAD (2004) considered that there is a great export potential and opportunities for developing countries as interest increases in organic food overall, and especially in products such as organic cocoa, most especially chocolate and beverages. This increase in demand for organic cocoa has caused organic chocolate sales to increase from \$US 171 millions in 2002 to \$US 304 million in 2005. Cocoa is the dried and partially fermented fatty seed from the cocoa tree. Cocoa is used for various products including chocolate and beverages. In 2005/2006 the world cocoa bean production was 3,731,000 tonnes with Africa producing 2,666,000 tonnes while in 2006/2007 an estimate of cocoa production was 3,500,00 tonnes. In 2006/2007, organic cocoa production accounted for less than 0.5% of the total world production with about 15,500 metric tonnes produced from countries including Venezuela, Fiji, India, Sri Lanka, Vanuatu Tanzania, Uganda, Belize, Bolivia, Costa Rica, Dominican Republic, El Salvador and Mexico (ICCO 2007).

Before the oil boom, cocoa production was the backbone of the Nigerian economy and accounted for 85% of Nigerian exports in the 1960s. However, Nigeria is still a major exporter of cocoa as it is the fifth largest producer of cocoa in the world with 4.6% of the world production and the fourth producer in West Africa. In 2006/2007, it produced 165,000 tonnes of cocoa. The major markets for cocoa in the developed countries are United Kingdom, France, Germany, Netherlands, United States and Canada (ICCO 2007).

Given the rapidly increasing world demand for organic cocoa, it is expedient to carry out a study that will explore the potential and economics of organic cocoa production in Nigeria, the costs incurred, the profit, demand and supply, barriers, the different production techniques, packaging and marketing methods and the international market for Nigerian organic cocoa. This will provide useful information that will facilitate the production of the organic cocoa in Nigeria.

1.2 Aim and Objectives

The overall aim is to assess the economic feasibility of producing and exporting organic cocoa in south-western Nigeria.

1.3 Specific Objectives

- (1) To report the production methods, certification and markets internationally for organic cocoa
- (2) To evaluate the production and marketing of conventional and non-certified organic cocoa in SW Nigeria
- (3) To identify the constraints in production, conversion, certification and exportation of organic cocoa in the study area
- (4) To predict the relative profitability of organic and conventional cocoa in the study area.

1.4 Outline of Study

This research was conducted by a combination of reviewing literature, administering questionnaires, secondary data collection and field surveys. The first chapter of this thesis consists of introduction, objectives of the study and the outline of the study.

In the second chapter, relevant literature is reviewed; this includes topics such as history of organic farming, agriculture in Nigeria, cocoa production in Nigeria, world market for organic products, world market for cocoa products, international certification and trade of organic products, production, harvesting and processing of conventional cocoa, pest/disease, nutrient management of organic cocoa production, importance of organic cocoa production. The third chapters consist of the study area, methodology, field activities, and questionnaire administration and data analysis. Chapter four consists of the research results, chapter five contains the economics of organic cocoa production and chapter six contains discussion, conclusion and recommendations.

CHAPTER TWO – LITERATURE REVIEW

2.1 History of Organic Farming

The concept of organic farming evolved in the 1930s by Sir Albert Howard who is the founder and pioneer of the organic movement. Due to his many years experience in agricultural research, he was able to formulate his concepts and theories of composting, soil fertility, and health and disease. The concept of organic farming came into the limelight when he discovered the importance of using available waste materials to build and maintain soil fertility and humus content. Howard (1943) emphasised the recycling of all organic waste materials, including sewage sludge, back to farmland for soil fertility, which he termed the ‘law of return’. His idea of recycling waste materials for soil fertility had previously been proposed in F.H. King's book *‘Farmers of Forty Centuries, Permanent Agriculture in China, Korea, and Japan’* in 1911 (Heckman 2006).

Concerning health and disease, Howard postulated that disease in plants, animals or humans was caused by unhealthy soil hence organic production techniques would make the soil healthy as well as those living on it. He was convinced by his observation that animals fed with crops grown in humus-rich soil were able to rub noses with diseased animals without becoming infected. In general, he was of the opinion that crop and animal health was a ‘birthright’ and that destroying pathogens is neither the best nor correct way of dealing with pathogen, but rather one should learn and make use of the pathogen for enhancing agricultural practices.

Due to the increased awareness of organic farming, in 1972, International Federation of Organic Agriculture Movements (IFOAM) was founded in France to diffuse and

exchange information on the principles and policy of organic agriculture in Europe (IFOAM 2005).

Similarly, in the USA from 1979 to 1990, organic farming was recognised at the national level and there was a growing interest in organic food and farming by the public with an increased interest in establishing standards for organic produce (food). In 1980, the USDA (1980) published a Report on Recommendations on Organic Farming Symposium titled "Can organic farming contribute to a more sustainable agriculture...?". They concluded that organic agriculture can definitely provide sustainability. In the same vein, California passed a law establishing a legal standard for organic production; these moves promoted widespread adoption of organic farming.

During this period, several advocates began to support 'sustainable agriculture' in order to promote organic farming. Among the main advocates was Gary Youngberg the founder of the Henry A. Wallace Institute for Alternative Agriculture. Rodale (1942) (page 6) who was also one of the earlier advocates of organic farming predicted that "*one of these fine days, the public is going to wake up and will pay for egg, meat, vegetable according to how they are produced.*" Currently, the increased number of environmental disasters and food scandals has facilitated the growing consciousness of consumers and increased policies advocating organic agriculture. In the last few years, the organic food market has increased by about 20% annually with an estimated 2.3 million ha farmed organically globally (FAO 2007a). The increasing demand for organically produced food and the high premium paid to farmers has ensured that organic farming has come to stay.

There are numerous theories or principles of organic agriculture set by different organisations. Although, there are slight differences in these sets of principles, they still all have the same basic aims of organic agriculture.

The general principles of organic agriculture are as follows:

1. Rely on renewable resources on a locally based agricultural system
2. Maintain biological diversity within the system
3. Recycle material and resources to the maximum extent possible within the enterprise
4. Protect the environment, minimize soil degradation and erosion, decrease pollution, optimize biological productivity and promote a sound state of health
5. Prepare organic products, emphasizing careful processing and handling methods in order to maintain the organic integrity and vital qualities of the production at all stage of production
6. Maintain long-term soil fertility by optimizing conditions for biological activity within the soil
7. Provide attentive care that promotes the health and meets the behavioural needs of livestock
8. Produce food of high nutritional quality in sufficient quantity
9. Promote the healthy use and proper care of water, water resources and all life therein
10. Encourage organic farming associations to function along democratic lines and the principle of division of power
11. Maintain the genetic diversity of the agricultural system and its surroundings, including the protection of plant and wildlife habitats

12. Allow everyone involved in organic production and processing a quality of life conforming to the UN Human Rights Charter, to cover their basic needs and obtain an adequate return and satisfaction from their work, including a safe working environment (Codex Alimentarius Commission 1999)

IFOAM (2005) principles on organic agriculture are subdivided into four as follow:

1. The Principle of Health - Organic agriculture should sustain and enhance the health of soil, plant, animal and human as one and indivisible
2. The Principle of Ecology - Organic agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them
3. The Principle of Fairness - Organic agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities
4. The Principle of Care - Organic agriculture should be managed in a precautionary and responsible manner to protect the health and well being of current and future generations and the environment

Several definitions have been used to describe organic agriculture by different authors and organisations. From these definitions the underlining statement is that the aim of organic agriculture is to sustain and enhance the health of ecosystems and organisms from the soil to human beings as well as to place great reliance on crop rotation, compost and green manure for soil fertility, and biological control of diseases and pests.

According to the Codex Alimentarius Commission (1999) and all existing national regulations “*organic agriculture is a holistic production management system that avoids use of synthetic fertilizers, pesticides and genetically modified organisms,*

minimizes pollution of air, soil and water, and optimizes the health and productivity of interdependent communities of plants, animals and people” (FAO 2007a).

The UNDP (1992) defined organic agriculture as “*the practise that involves managing the agro ecosystem as an autonomous system, based on the primary production capacity of the soil under local climatic conditions.*” The US Department of Agriculture defined organic faming as the production system that avoids the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock feed additives (USDA 1980).

IFOAM (2002) described organic farming as an agricultural system that promotes environmentally, socially and economically sound production of food and fibre. Organic agriculture is said to be an approach to agriculture where the aim is to create an integrated, humane, environmentally and economically sustainable agricultural production system (Lampkin, Measures and Padel 2002). In 2007, IFOAM defined organic farming as any agricultural system that sustains and enhances health, ecology and fairness in a responsible manner. In 1995, USDA National Organic Standards Board (NOSB) defined organic agriculture as an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity (Gold 2007).

Organic farming is a form of agriculture which excludes the use of synthetic pesticides, fertilizers plant growth regulators, livestock feed additives and GMOs. Organic agriculture is a holistic system designed to optimize the productivity and fitness of diverse communities within the agro ecosystem, including soil organisms, plants, livestock and people (NSCOA 2006).

2.2 World Markets for Organic Products

The growing organic market accounts for 1-2% of world food sales. This food sector is growing faster than other food industries with future growth estimates ranging from 10-50% annually (IFOAM 2007). The market for organic products is becoming increasingly important as its sales increased by over five billion US Dollars yearly and the international sales reached 38.6 billion US Dollars in 2006, doubling the sales in year 2000 which were estimated as 18 billion US Dollars (Willer, Yussefi, and Sorensen 2008). This dramatic increase in organic sales has been stimulated by consumer concern over the high levels of saturated fat (cholesterol), sugar and pesticide residues in food they consume as well as the increasing awareness of the environmental damage which is believed to be a result of modern agriculture and Green Revolution technologies practised globally. North America and Europe are the largest markets for organic products and these two regions comprise 97% of the global revenue (Sahota 2005).

2.3 International Certification and Trade of Organic Products

For a product to be called organic it must be certified by a certification body, hence organic certification is the process/procedure by which a produce is certified to be organic. For a product to be certified as organic, the product must be produced under strict standards set by the organic organisation. The essence of organic certification is to ensure the quality of the produce as well as to promote and regulate the sales of these products to the consumer. Farmers get their product certified by the different certification bodies and can add a logo or symbol of these certification bodies which differentiates their produce from others. Certification of the production identifies the

products as organic. Certification bodies can be either state or private organisations (IFOAM 2002). Certification involves applying organic standards, documenting farm history and current set-up, inspection of the farm lands and processing facilities, keeping detailed records, and paying of certification fees (IFOAM 2002). The most common certification bodies in Europe include the Soil Association which certifies about 70% of organic product in the UK, the Organic Food Federation (OFF), Organic Farmers and Growers Ltd (OF&G), Demeter (BDAA), Irish Organic Farmers and growers (IOFGA), Scottish Producers and Growers Association (SOFA), BIOHELLAS, DIO, Aclave, Agrocet., Bioland, Ecoland, Naturland, Biokrev, Ulase, SGSICS and ASBL (Association Sans But Lucratif) while in the US, National Organic Program and California Certified Organic Farmers are the most common certification bodies.

2.4 Agriculture in Nigeria

Nigeria is predominantly an agricultural society and is called ‘land of honey and milk’ (Uchendu 2007) owing to its highly diversified agro-ecological conditions which make production of a wide range of agricultural products possible. Agriculture is a very important sector of the Nigerian economy, providing numerous employment opportunities with 70% of the population engaged in agriculture at a subsistence level. It also provides raw materials to both agro and chemical industries thereby contributing to the national GDP. In spite of Nigeria’s heavy dependence on the oil industry, agriculture’s contribution to national GDP cannot be overlooked, as it contributes 37% of Nigerian GDP accounting for ₦ 77.76 billion out of the total ₦ 97.04 billion generated from non-oil sector (Uchendu 2007).

Several studies have shown that Nigeria's agriculture sector is growing at a decreasing rate, in spite of the Food and Agriculture Organization of the United Nations (FAO) conclusion that most of the country's soils are fertile enough to be highly productive. Numerous factors are responsible for this. For instance, less than half of the 80% of the cultivatable land has been cultivated and much of agricultural production is small scale (FAO 1998). Nigerian staple food crops are cassava, yams, maize, coco-yams, cowpeas, beans, sweet potatoes, millet, plantains, bananas, rice, sorghum, and a variety of fruits and vegetables, while the cash crops include cocoa, citrus, cotton, groundnuts (peanuts), palm oil, palm kernel, sesame and rubber. The livestock sector includes cattle rearing, piggery, fishing and poultry.

Nigerian agriculture, as in many other developing countries, especially African countries, is known to be low resource and heavily dependent on labour and agro-chemicals like fertilizers, insecticides and pesticides (FAO 1998). Figure 2.1 shows labourers working on a farm in which the clearing and preparation of land are done manually by the use of hoes and cutlasses.

Figure 2.1: Farmers (labour) working on a farm. Source: Wikipedia (2008a)

Nigeria's major exports before the oil boom were mainly cash crops such as cocoa, groundnut, cotton, gum arabic, sesame seed, rubber, ginger, mangoes, pineapples and coffee. The main export markets for Nigerian agricultural produce are Britain, Canada, China, France, Germany, Gulf States, Singapore and the United States. Owing to its fertile lands and also its proximity to traditional and terminal markets in Europe, Nigeria has an added advantage over the major agricultural producers and exporters in the East and South of Africa (Sasore 2005). Table 2.1 shows the value of Nigerian agriculture exports in the year 2005. The exchange rate is ₦ 275 to £1

Table 2.1: Value of Nigerian agricultural export

SECTOR	Export proceeds (Naira)
Finished leather	25,391,887,270
Cocoa beans	13,011,132,813
Rubber	6,309,940,175
Cashew nuts/kernels	3,708, 974,53
Gum arabic	1,907,609,533
Ginger	730,751,173
Palm produce	102,209,464
Arable crops	89,928,666
Hibiscus flower	50,851,529
Cow horns/ bones	13,555,603
Vegetable	10,045,389
Fish bladder	8,066,162
Coffee	7,091,958
Sesame seeds	3,717,990
Groundnuts	1,382,400

Source: Adapted from Nigerian Export Promotion Council (NEPC 2004).

2.5 The World Market for Cocoa (Conventional and Organic)

West Africa has consistently provided about 70% of the world's cocoa production. A higher contribution was observed in 2003/2004 when 72% of the global cocoa output was produced in West Africa. In this region, the four major cocoa producers are Ivory Coast, Ghana, Nigeria and Cameroon in order of their production, Ivory Coast and Ghana produced 43% and 16% of the world production, respectively. Compared with West Africa, Asia and Oceania combined produce only 20% of the annual global cocoa output with Indonesia as the major producer in the region (14% of global production), and the Americas produce 10% of the annual global cocoa output. Other countries across the globe which are significant cocoa producers include Malaysia, Brazil and Papua New Guinea (ICCO 2007). Table 2.2 below shows the major producers and production of cocoa beans in the world.

Production and demand for cocoa will continue to increase globally over the years due to the emergence of new markets for cocoa as well the health benefits of its products. The World Cocoa Foundation (WCF) estimated world cocoa production to be between 3.4 and 3.8 million tonnes in the 2006/07 production season. However, FAO projected that by 2010, the global cocoa production will be 3.7 million tonnes while the world cocoa production growth was projected to be 2.7% per annum between 2007/08 and 2011/2012 production seasons as against the current 1.9% per annum growth. The world production was forecasted to be 4.1 million at the end of 2011/2012 season (MC 2007).

In the same view, the world cocoa grinding process (whereby cocoa nibs (cotyledon) are ground to release cocoa fat; during this process frictional heat is produced making (the cocoa fat liquefied and chocolate liquor is obtained) will also increase as it is

expected to increase from 3.6 million in 2007/2008 to 4.1 million tonnes by 2010/2011 with a growth rate of 3.4% annually. The world grinding and production is expected to increase from 1.74 million tonnes in 2006/2007 to 1.98 million by 2009/10. Market share of production in developing countries especially in Ghana and Cameroon was projected to increase from 21% in 2006/07 to 22% in 2011/12 respectively (MC 2007). World cocoa consumption was estimated at 2.8 million tonnes per annum with European countries the largest consumers of cocoa, importing over 1.2 million tonnes Annual cocoa consumption in Great Britain is 0.5 million tonnes, followed by the United States having 0.4 million tonnes. Chinese consumption increased to 9,000 tonnes in 2000. The world cocoa production has been fluctuating over the years, Figure 2.2 shows the trends in cocoa production and Table 2.2 and 2.3 shows major producers and production of cocoa beans (thousand tonnes) and consumption of cocoa beans (thousand tonnes) respectively.

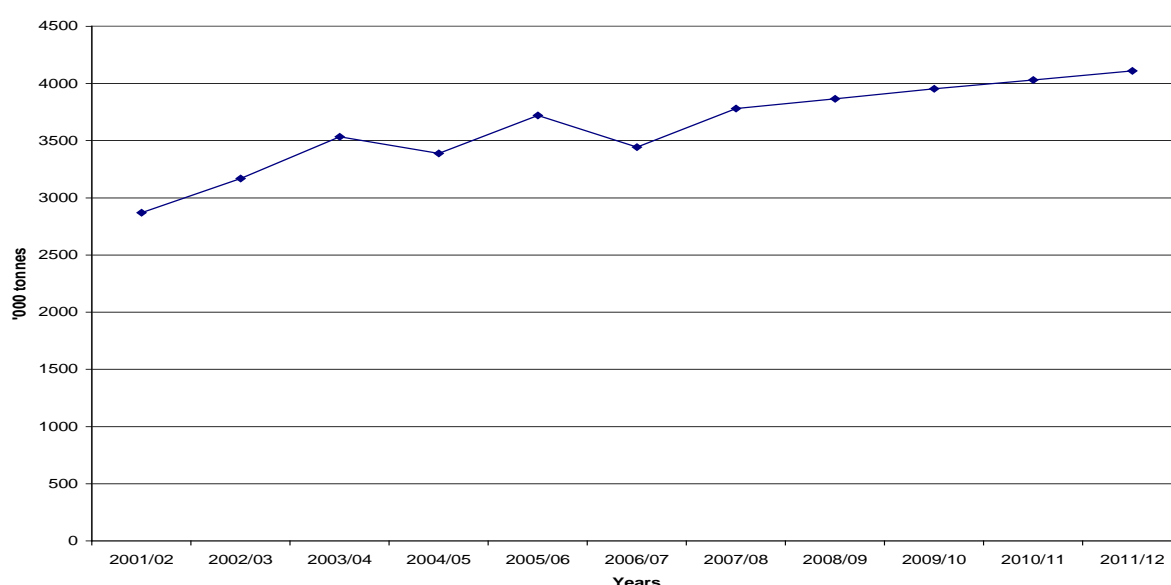


Figure 2.2: Forecast of world cocoa production

Source: Adapted from ICCO (2007)

Table 2.2: Major producers and production of cocoa beans (thousand tonnes)

Source: ICCO (2007)

Table 2.3: Consumption of cocoa beans (thousand tonnes)

Source: ICCO (2007)

2.5.1 World Market for Organic Cocoa

Although the demand for organic produce has increased in recent years, organic cocoa accounted for less than 0.5% of the total cocoa production (ICCO 2006). Certified organic cocoa is estimated at 15,000 tonnes. In Europe, organic cocoa has 0.8% of the market share (Koekoek 2003, ICCO 2006).

However, demand for organic cocoa products is growing alongside the organic market as a whole. Consumers' concern for food safety is increasing as well as concern for environmental safety issues such as reduction in hazard effects on cocoa farmers

during the application of agro-chemicals including pesticides. Global organic chocolate sales increased from US\$171 million in 2002 to US\$304 million in 2005.

In the USA, the sales of organic cocoa increased by 120% from 2002 to 2006 to reach over US\$400 million (ICCO 2006).

Latin America, including Central and northern South America is the leading organic cocoa producing region and its products are exported to America and Europe. Other organic cocoa producers include Ghana, Madagascar, Peru, Tanzania and Boliva, while other African and Asian countries are limited suppliers of the products (ICCO 2006). Presently, Ghana is one the world leading producers of the best quality organic cocoa beans. Ghana supplies organic cocoa for Green & Black one of the major manufacturers of cocoa which uses 25% of the world's organic cocoa (Mesure 2007). Europe and America are the major market for organic cocoa and its products. In 2003, Europe imported 14,000 tonnes and 2,000 tonnes was re-exported to America (Koekoek 2003).

2.6 Cocoa Production in Nigeria

The contribution of cocoa to Nigeria's economy cannot be overemphasised, especially in terms of its contribution to the foreign exchange of the nation. Cocoa production is known to provide a sizeable employment to the public, important raw materials and a source of revenue to its producing state (Falusi 1997). About 345,000 t of cocoa are produced in Nigeria with South Western Nigeria producing 70% of this (242,000 t) (Gockowski and Oduwole 2001). There has been a decline in cocoa production as FAO (2005b) estimated Nigerian cocoa bean production as 178,000, 174,000 and 206,000 metric tonnes in 2002/03, 2003/04 and 2004/05, respectively with a forecast production of 190 and 165 metric tonnes in 2005/06 and 2006/07, respectively while

ICCO stated Nigerian cocoa production to be 173, 180, 200, 200 and 190 metric tonnes for year 2002/03, 2003/04, 2004/05, 2005/06 2006/07 respectively. With the intervention of the National Cocoa Development Committee (NCDC), cocoa production has increased from 170,000 tonnes in 1999 to about 338,000 tonnes in 2006 and an additional 11,576,000 seedlings were raised between 2004 and 2006 making a total of 30 million seedlings raised to date (NCDC 2008). The fourteen cocoa producing states in Nigeria are Abia, Adamawa, Akwa-Ibom, Cross River, Delta, Edo, Ekiti, Kogi, Kwara, Ogun, Ondo, Osun, Oyo and Taraba with the states in the South-West having the greatest production. The trend of cocoa production has been declining over the years due to the shift in interest to crude oil production. In Nigeria, cocoa is planted as a plantation. Figure 2.3 shows a cocoa plantation visited during the field survey of this research. Figure 2.3 gives an idea of the spacing employed in an ideal cocoa plantation.



Figure 2.3: Cocoa plantation

Source: Field survey, April 2008

2.7 Production, Harvesting and Processing of Conventional Cocoa

Different cocoa varieties are grown across the globe; the most common variety of cocoa grown in Nigeria is a hybrid, which takes 3-4 years to fruit (CRIN 2001). Cocoa farming can either be shaded or sun cocoa farming. In Nigeria, shaded cocoa farming is the dominant production system. Cocoa shade farming involves planting of young cocoa plants with temporary shade crops such as plantains, banana and cocoyam in order to provide good shade during the dry season (Darko and Jinor, 2004). CRIN (2001) recommended 10 x 10 m spacing for a cocoa plantation.

The management of a cocoa farm involves weed, pest and disease control. Application of inorganic fertilizer such as NPK 15:15:15 or urea is not common in cocoa farming in Nigeria as organic manure or mulch serves as a substitute for inorganic fertilizer. Weed, pest and disease control predominantly involves the use of agro-chemicals. In West Africa, the major diseases of cocoa are *Phytophthora* pod (black pod disease) and cocoa swollen shoot. Similarly, mirids have been found to be the number one insect pest on cocoa in West Africa. Both diseases and insect pests are controlled by chemical control, traditional practices (involves reduction of shade, regular weeding and pruning of cocoa trees as well as regular removal of epiphytes and chupons) and breeding of resistance varieties (Darko and Jinor 2004). Chemical control involves the use of agro-chemicals, for instance the fungicides commonly used to control black pod are Ridimil and copper sulphate, and the insecticides used including Basudin and Capsitox 20 (Phuoc *et al.* 2008).

Four elements responsible for the quality of cocoa beans include variety, pest, environment and post-harvest handling. Post harvest handling includes the following processes:

Pod breaking: this involves the breaking of harvested pods to remove the cocoa beans. The breaking of cocoa pods is done using a cutlass or preferably a stick so that the beans will not be damaged by the cutlass.

Fermentation: there are different fermentation methods such as basket, heap and wooden fermentation box. The heap method is most common in Nigeria; it involves putting banana leaves or polythene on the ground protecting the beans from impurities, and cocoa beans are then spread on this. Banana leaves are used to cover the cocoa beans. They are left for 4 days to ferment. On the fifth day, cocoa beans are turned to improve ventilation and uniformity of bean mass. After turning, cocoa beans are again covered and left for another day. On the sixth day, the fermented cocoa beans are collected and dried under the sun. Concrete floors, mats and polythene bags can be used for the drying. Fermented cocoa beans take 5-10 days to dry.

Storing of cocoa bean: dried beans are weighed and stored in bags or sacks. Jute bags are preferred as this allows air circulation. Bagged beans are stored in dry and well ventilated conditions in the farmers' houses or licensed stores (Phuoc *et al.* 2008). Likewise, in organic cocoa production, the same post harvesting processes are carried out.

2.8 Pest, Disease and Nutrient Management of Organic Cocoa Production

Organic agriculture as a holistic production requires every process (production, nutrient management, and pest and disease control) to be done organically. Currently, modern agriculture depends largely on external inputs/agro-chemicals such as pesticides, inorganic fertilizer, and insecticide for higher productivity. In organic

agriculture fertilizer are replaced by manure, compost and nitrogen fixing crops while pesticides are replaced by biological, cultural and mechanical method of pest and disease control (Pretty 1998).

In organic farming, several methods have been adopted for pest and disease control. For instance, in Ghana, organic cocoa farmers control black pod disease (a predominant fungus disease of West African cocoa) by traditional practices. This aims to reduce the relative humidity below the cocoa canopy by proper air circulation. This traditional practice involves reduction of shade, regular weeding and pruning of cocoa trees as well as regular removal of epiphytes and chupons. Similarly, breeding of resistant varieties that have durable resistance to the pathogen is also a method of controlling black pod disease. For cocoa swollen shoot, another major disease of cocoa in Africa, removal and burning of infested trees has been recommended (Darko and Jinor 2004).

Farm sanitation and bio-control are known to be effective organic practices in combating pests. Organic cocoa farmers in Ghana use mealy bug-farming ant (black cocoa ant) to eliminate mirid (capsid) infestation. In the same vein, Nigerian cocoa farmers use yellow ant (salamo) to eradicate other insect infestations. It was discovered that the presence of yellow ants on cocoa trees deter all other insects on the trees but yellow ant is not farmer friendly because it bites. Furthermore, Ghanaian cocoa farmers use neem extract treatment (neem extract can be made from every part of the neem tree as these part contain a natural chemical known as azadirachtin; but the leaves are mostly used) to combat capsid outbreak. Neem extract (neem leaves are soaked in water for few hours, the water is collected and then sprayed) does not

kill pest/ insect instantly but alters the life cycle or the feeding system of the pest until it no longer lives or reproduces.

Organic manures or mulches, crop rotation and intercropping are the predominant nutrient management methods. Crop residues, green manure, bio-fertilizers and animal dung are the major sources of nutrients in organic farming. Manures have the ability to effectively fulfil nutrient requirement of crops as well as promoting beneficial macro and micro-flora activities in the soil (Rai 2005).

2.9 Importance of Organic Cocoa Production

Like any other organic products, organic cocoa has numerous advantages over the conventional. This includes health, environmental and economic advantage. Darko and Jinor (2004) reported that in Cameroon and Ghana organic cocoa farmers enjoy the following:

- a) High premium prices for organic cocoa
- b) Organic cocoa encourages reforestation
- c) Creation of jobs as well as facilitating rural development in cocoa growing areas
- d) Lower production cost
- e) Multi-cropping done to improve organic cocoa farming leads to extra revenue for the farmers and also serves as security in case of any fall in organic cocoa price
- f) Avoiding hazards and indiscriminate use of chemicals by farmers

g) Organic cocoa can be sold as ordinary cocoa beans if premium price is not paid on organic cocoa

Similarly, Phouc *et al.* (2008) concluded that organic cocoa production in two regions in Vietnam (central highland and Mekong Delta) is attractive because of:

- a) Fertile soil suitable for organic cocoa production
- b) Existing farmers skilled in production of cash crops
- c) Suitable climatic condition for cocoa production
- d) Most farmers practising some organic principles (bio-control method),
using natural enemies to control pests (black ant colonies).
- e) Availability of organic matters such as animal manure, rice straw,
water hyacinths
- f) Higher profitability of cocoa production as against the current crop production.

CHAPTER THREE –RESEARCH METHODOLOGY

3.1 Study Area

Nigeria is subdivided into six geo-political zones which comprise 36 states and one Federal Territory Capital. Figure 3.1 shows the different states. Nigeria's current population of about 148 million has increased by 63% since the last census in 1991 (National Population Commission (NPC) (Nigeria) 2007). Nigeria lies at latitude 10°00'N and longitude 8°00'E. With a total area of 923,768 km² it is the World's 32nd-largest country (Wikipedia 2008b). Nigeria lies in the tropical zone with varying climatic conditions across the country ranging from arid to rainforest. It has a tropical climate with two seasons, a wet season from April to October and a dry season from November to March with June the wettest month. Average annual precipitation varies from 1,770 mm in the west to 4,310 mm along the east coast, and to 470 mm in the central areas, and average annual temperature ranges between 23°C and 32°C. Thus the climatic conditions make the country agrarian with a fertile soil, which supports the growth of crops like cocoa, peanuts, palm oil, corn, rice, sorghum, millet, cassava (tapioca), yams and rubber, rearing of livestock such as cattle, sheep, goats and pigs, and timber and fish. Nigerian GDP is estimated as \$294.8 billion. Natural resources found in the country include natural gas, petroleum, tin, columbite, iron ore, coal, limestone, lead, zinc and arable land. The empirical setting for this study consists of five states in the south-western zone of Nigeria namely: Ondo, Oyo, Osun, Ogun and Ekiti states of the fourteen predominant cocoa producing states. Despite the fact that Lagos state is one of the states in the zone, it has not been included because of its negligible cocoa production (NCDC 2008).

3.2 Study Data and Methods of Data Collection

3.2.1 Data Collection

The data used for this study was classified into primary and secondary data. Data collection methods used were questionnaire, farm surveys, visits and discussion with relevant organisations such as Olusegun Obasanjo Centre for Organic Research and Development (OOCORD), Cocoa Research Institute of Nigeria (CRIN) and the various Cocoa Development Units (CDUs) of the five states. The study was a 6 week

field survey in Nigeria. Primary data (qualitative and quantitative) were collected from the cocoa farmers using a structured questionnaire designed to provide information such as farm size, yield, variable and fixed costs, socio-demographic characteristics of the farmers, the different packaging methods and production barriers. The researcher attended the 2008 NCDC (National Cocoa Development Committee) conference held in Akure, Ondo State in order to have an opportunity to interact with different stakeholders in cocoa production as well as the cocoa farmers.

Figure 3.1: Map of Nigeria showing the states (Boomie 2009)

3.2.1.1 Secondary Data

In any research, secondary data cannot be over emphasised as it provides useful information on what has been done, suggests what is to be done or modifications that

need to be done. These data are obtained from sources such as journals, articles, reports, textbooks, various relevant website and organisations. Thus the secondary data used in this study were literature on the history and importance of organic farming, statistics on the world cocoa production, study area description and organic cocoa production.

3.2.2 Sampling Procedure

As mentioned above, the study area for this research is the five cocoa producing states in the south-western Nigeria. Due to the number of cocoa farms and the time constraint, this study adopted a multi-stage and purposive sampling technique. As a multi-stage sampling technique, the different stages involved were;

First stage: five cocoa producing states were purposively selected in Nigeria, from the list of the states in the country, by the dividing the country in six geo-political zones. Six states make up the south-western zone; the major cocoa producing states in the zone were selected.

The second sampling stage involved the selection of two major Local Government Areas (LGA) from the cocoa producing LGAs in each state. States with the fewest LGAs have at least twenty LGAs which were not feasible for the researcher to cover within the time frame of the survey. Table 3.1 shows the major cocoa producing LGAs in each state.

Table 3.1: The major cocoa producing LGAs in each of the five states in SW Nigeria sampled

STATE	Major cocoa producing LGA
Ogun	Yewa North, Ijebu East
Oyo	Ona ara, Oluyole
Ondo	Akoko North East, Akoko North West
Osun	Ife South, Ife East
Ekiti	Ekiti West, Ekiti East

Statistics and data on cocoa production, cocoa farmers and LGAs producing cocoa were obtained from Cocoa Development Unit (CDU); a governing body that oversees cocoa production in each state. With the information provided by the CDUs, the research was able to identify the two major producing LGAs of cocoa.

At the last stage, cocoa farmers were selected and sampled. The major producer LGAs each comprises a large number of farming communities/settlements. Lists of cocoa producing settlements and farmers were provided by the project manager of each state CDU. The contact farmers (usually the major cocoa farmers) in the major farming settlements were chosen and interviewed. Other farmers within the farming settlement or in the neighbouring farming settlement that were recommended by these contact farmers were also interviewed. The study interviewed 20 farmers in each state with 10 farmers interviewed across the various farming settlements of each major producing LGA. Figure 3.2 is flow chart used for the multi-stage sampling.

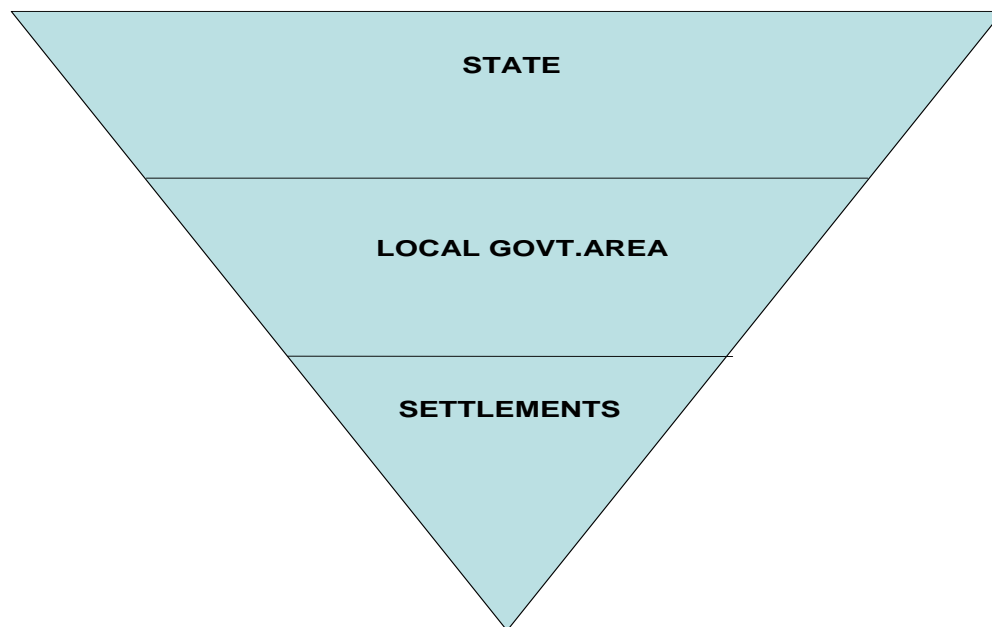


Figure 3.2: Flow chart describing the multi-stage sampling

In total, one hundred cocoa farmers were interviewed, twenty cocoa farmers were sampled in each state with ten farmers interviewed across the various settlements in each of the two LGAs.

3.2.3 Questionnaire Administration

A questionnaire is a tool of data collection (Oppenheim 1992), while Gilham (2000) defined a questionnaire as a way of getting information from people without necessarily asking them questions. Robson (2002) said questionnaire administration can be carried out in three ways:

- (a) Self administration: this involves completing of questionnaire or answering of questions by the respondent themselves, respondents are usually educated (i.e can read and write)
- (b) Telephone interview involves asking of questions on the phone and information provided by the respondent will be recorded. In this case, the respondent may not necessarily be educated but the language used by the researcher should be understood by the respondent.
- (c) Face to face interview: occurs when an interviewer asks questions and also complete the questionnaire in the presence of the respondent. This is usually done when the respondent is not educated.

For the different questionnaire administration methods mentioned above, two question types can be used: open ended questions which are questions that allow the respondent an opportunity to write responses that best answer the questions for them and closed questions which are questions answered using “yes” or “no” or a selection from multiple choices.

The questionnaire for this study was developed by researching various questionnaires used for similar research. After the development of this questionnaire, the researcher then sent copies of the draft questionnaire to relevant professionals for correction and suggestion. Thus a valid questionnaire was obtained. On arrival in Nigeria, a test run of the questionnaire was done with a few cocoa farmers and useful suggestions and amendments were incorporated into the questionnaire. A copy of the questionnaire is included in the Appendix.

For this study, the questionnaire was written in English and was read to the farmers in local language (Yoruba), a general language in the areas as most farmers interviewed could not read or write. The consent of the village heads of the farming communities and individual cocoa farmers were sought verbally before administering the questionnaires. Face to face questionnaire administration was employed in this study. Questions set in the questionnaire were both open ended and closed. For the open ended questions, farmers were able to express themselves by providing their own answers to the questions and closed question provided farmers with a choice of answers.

In the questionnaire, some questions were asked more than once, to serve as a cross check of information as farmers may give false information when it comes to their income, costs and some other information. During the administration of the questionnaire, the researcher talked about the basic and fundamental information of organic production and its benefits as most farmers claimed they were not aware of organic production. Thus the information given by the researcher encouraged the farmers to be willing to adopt organic cocoa production. Farmers were also allowed to ask questions and the researcher attempted to provide relevant answers. The questionnaire administration was conducted in the presence of the different state CDU officers as farmers are unwilling to provide information to strangers thinking that information provided by them can be used against them or fearing that the interviewer may be a spy from the government. The questionnaire administration was done on the farm or at the farmers' houses depending on the availability of the farmers interviewed. The questionnaire administration was achieved without difficulty and the researcher was welcomed by the farmers. The researcher had undertaken a course on research and extension survey during her undergraduate programme and this helped with the approach and personal presentation. The farmers were ready to be interviewed, there was no apparent resistance based on the age or gender of the research and, in fact, the farmers were impressed that a young woman could come from abroad to relate with them in the local language and even be ready to learn from them as well as imparting knowledge. Surprisingly, no farmer refused to be interviewed and even more farmers wanted to be interviewed after the allotted number of cocoa farmers for the location had been sampled.

3.2.4 Farm Survey

Farm survey is said to be important in any research as it permits the researcher to have a direct observation and gather information as well as having a clearer picture of information provided by the respondents to check for false or biased information (Robson 2002). In this study, questionnaire administration done on some farms allowed the researcher to observe the different cocoa plantation in term of farm size, type of farming system, pest/insect infestation and processing of cocoa. Farmers were willing to provide answers as talking to the farmers on their farm made them feel secure and they also wanted to boast about their farms. Photographs of farmers and their farms were also taken with permission.

3.2.5 Cocoa Conference

Attending the 2008 National Annual Cocoa Conference enabled the researcher to meet groups of cocoa farmers, as well as providing an opportunity for the researcher to talk to a large number of cocoa farmers at a time about organic production, its benefits and constraints. There was a question time section where farmers' questions and suggestions were recorded by the researcher. Different groups of cocoa marketers were also contacted during conference.

3.3 Methods of Data Analysis

The analytical tools that were employed for this study are descriptive statistics, analysis of variance, correlation analysis and gross margin analysis.

3.3.1 Descriptive Statistics

The data were presented in frequency tables and simple percentages were used to describe the socio-demographic characteristics of the cocoa farmers and their farms. Farm size, yield, weed control, insect/pest control were assessed as was awareness and willingness to convert to organic agriculture, and problems in adopting organic agriculture were identified.

3.3.2 Analysis of Variance (ANOVA)

Analysis of variance is a statistical method used to analyse variable data from multiple groups in order to compare means and analyse sources of variation. It is also known as a technique used to determine significant differences between two or more sample means. The major assumptions in ANOVA are:

- (i) ANOVA assumes that the observations are independent of each other.
- (ii) It assumes that variance of response variables is the same for all populations
- (iii) It assumes the response variable to be normally distributed.

ANOVA can be carried out using the Excel package. ANOVA is divided into (a) one factor Analysis of Variance: this is calculated to test hypothesis means from two or more samples drawn from the population with equal means (b) two factor Analysis of Variance (c) multiple factor Analysis of Variance (Dorner 1997). This study employed one factor analysis.

3.3.3 Correlation Analysis

This analysis was used to determine the relationship between pairs of variables in the study. Correlation analysis was carried out to see if there is any correlation between variables such as yield per ha and work experience of the farmers. Correlation can be either positive or negative. Pearson correlation analysis was used in this study and it is mathematically represented below:

$$r = \frac{\sum_{i=1}^n (X_i - \bar{X})(Y_i - \bar{Y})}{(n-1)S_X S_Y}$$

Where r is a number that ranges from +1 to -1

3.3.4 Gross Margin Analysis

Gross margin analysis is a method used to determine the sales revenue obtained when an item sold after the direct costs of production have been subtracted. The direct costs of production of a commodity are the total variable costs incurred in the production.

The Gross margin is mathematically represented as:-

$$\text{Gross margin} = \text{Revenue} - \text{Costs of production}$$

CHAPTER FOUR - RESULTS

4.1 Socio-Demographic Characteristics of the Farmers in the Study Area

4.1.1 Gender of Farmers

The majority of the cocoa farmers interviewed were male (89%), female farmers accounted for only 11% of the total sample (Figure 4.1). This agrees with Weise (2006) that cocoa is generally perceived as man's crop in both West and Central Africa. This suggests cocoa production is gender biased due to the strenuous nature of production and the traditional belief that males are the heirs of the family and have the right to inherit their parents' properties.

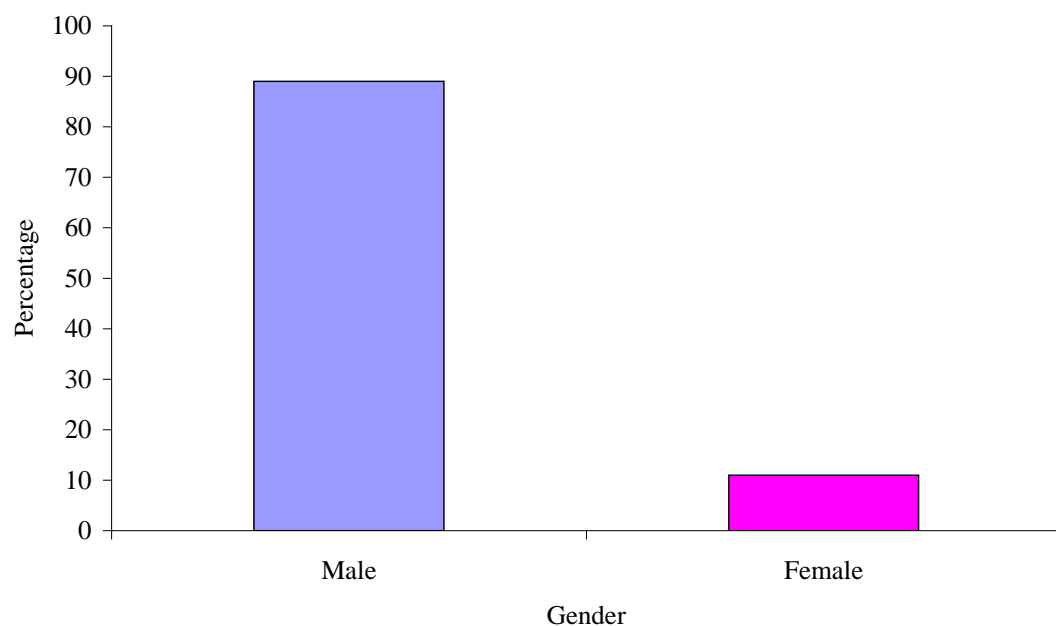


Figure 4.1: Distribution of farmers by gender

4.1.2 Age of Farmers

The average age of the farmers interviewed was 56.7 years. The largest numbers of farmers were in the age bracket of 61-70 years (32%) (Figure 4.2). This may be because cocoa trees take a long time before they start fruiting and younger people are

interested in more rapid returns on investment. Likewise, the inheriting of parents' properties by the elder child may be responsible.

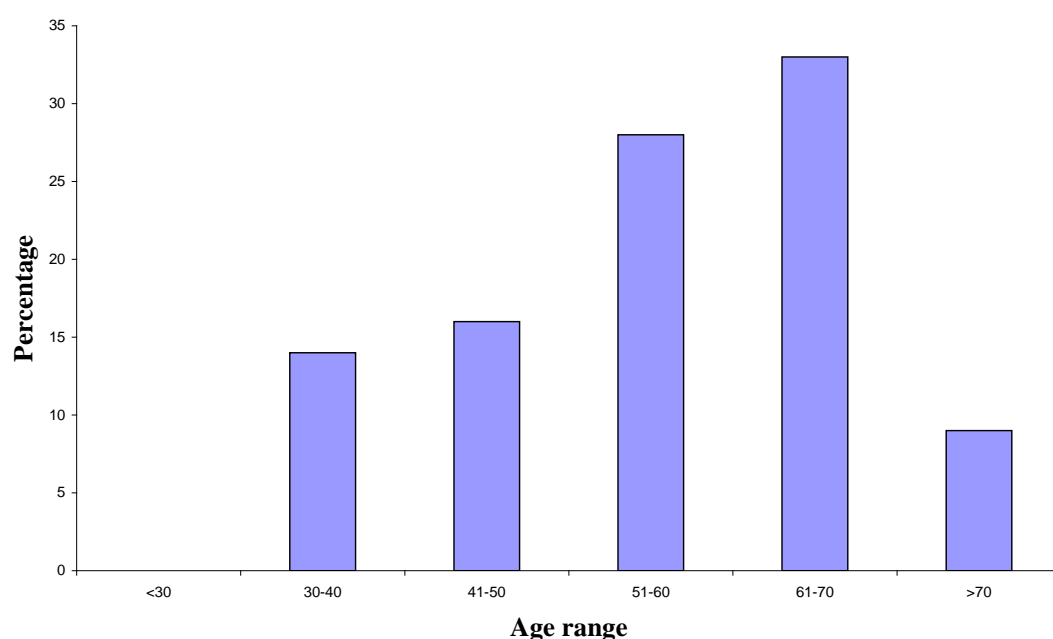


Figure 4.2: Distribution of farmers by age

4.1.3 Educational Level of Farmers

A large percentage of the farmers in the sample have no formal education (34%) while 66% of the sample had at least primary school education (Figure 4.3). This may be because older people are involved in cocoa production and they did not have the opportunity to go to school.

4.2 Farm Size

There was a wide variation in the farm size. The smallest farm surveyed was 0.5 ha while the largest was 80 ha. However, the mean farm size was 7.23 ha and 84% of the farmers have farm size between 0.5 and 5 ha (Figure 4.4). This is in conformity with results of other research that shows small scale production (less than or equal to 5 ha) is predominant in developing countries (IFOAM 2005).

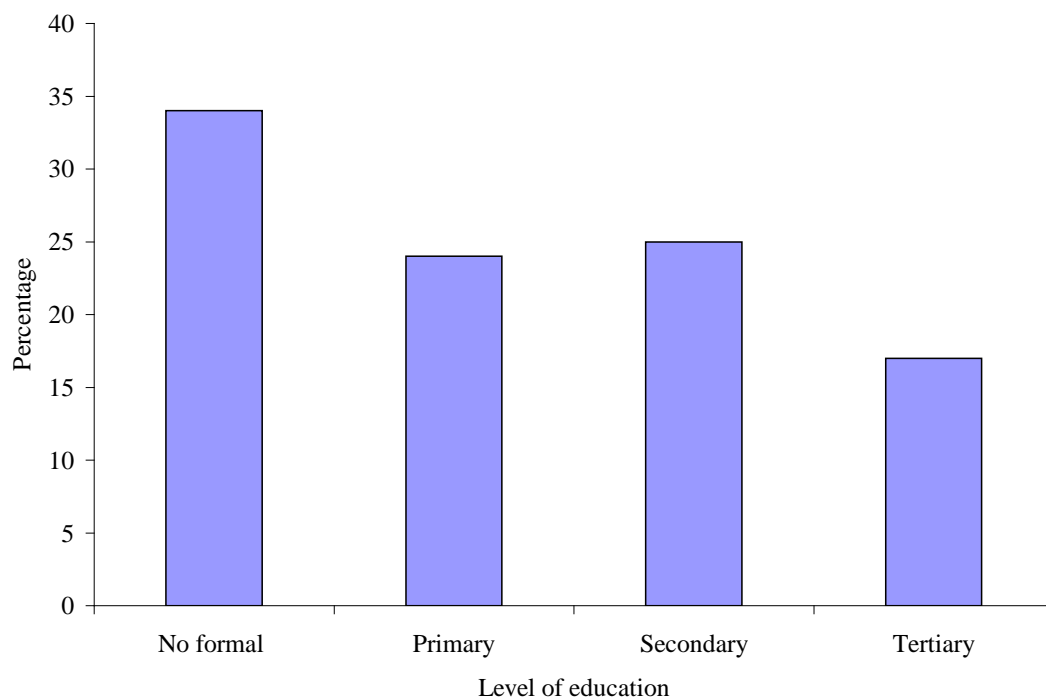


Figure 4.3: Distribution of farmers by educational level

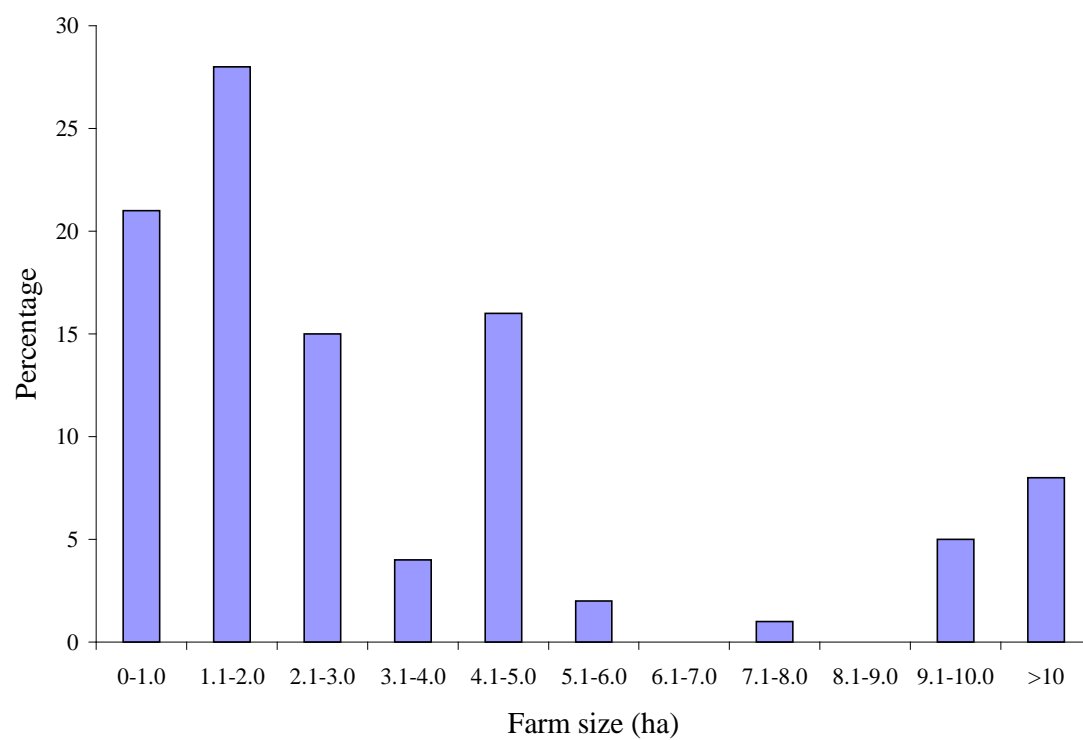


Figure 4.4: Farm size distribution

4.3 Source of Farmland

The majority of farmers (72%) reported that they inherited their farmland (Figure 4.5). At present very few cocoa farmers (3%) obtained land or leased land from the government. A rented land is land that has a stated return or payment for a temporal possession while a leased land is when the land has a defined duration for its usage by the farmers. An inherited farmland occurs among members of a family usually by heredity where the family land is transfer to the heir of the family. A purchased land is a land that has been bought by the farmer and it belong to him (personal belonging /property). Government also helps the farmers by providing land for cultivation and by so doing the government encourages farmers to go into agriculture.

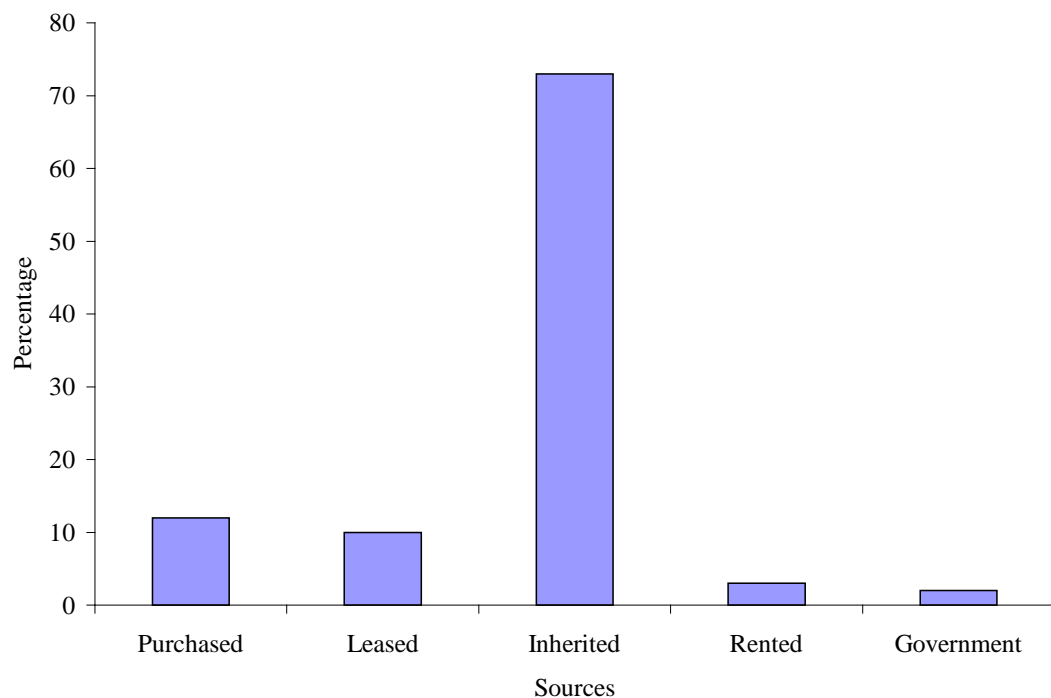


Figure 4.5: Distribution of farmland by source

4.4 Farming System

The majority of the farmers interviewed practised mono-cropping (83%) while 17% of the farmers practised mixed-cropping (Figure 4.6). Farmers (17%) reported that cocoa can be planted in a mixed crop system with arable crops, citrus, kola-nut, yam, pineapple and cassava. In mono-cropping, banana trees are planted as a nurse crop on cocoa plantations in order to provide shelter for the growing cocoa trees. Once the cocoa trees are fully grown, the banana trees are then cut down.

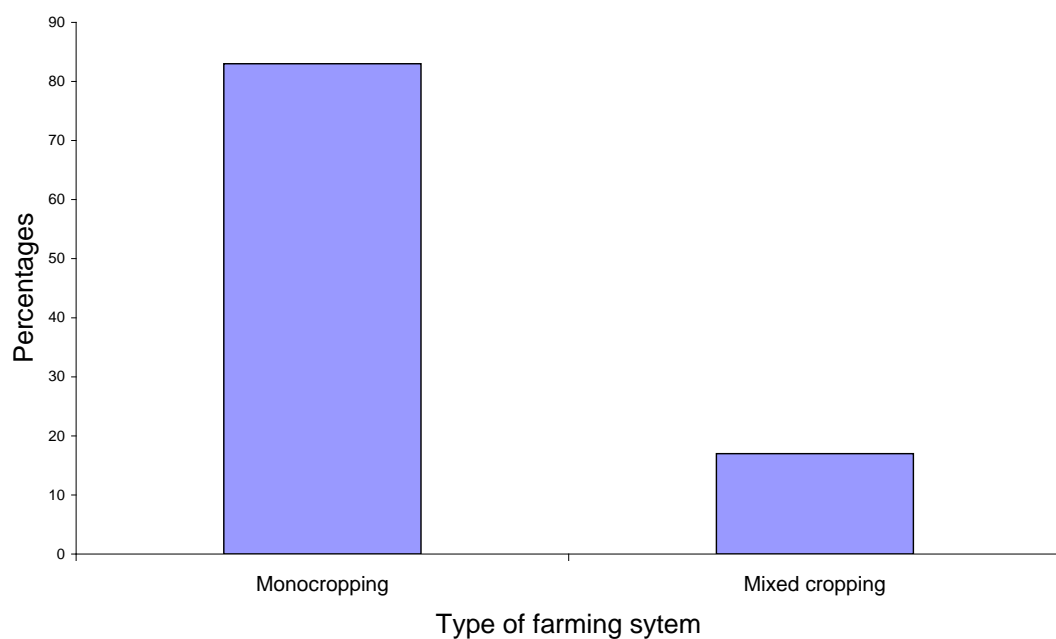


Figure 4.6: Distribution of farming system practised

4.5 Sources of Finance

The majority of the farmers interviewed used their personal savings as capital, either wholly (76%) or in combination with other sources (Figure 4.7). None of the farmers reported that they get their capital solely from banks. Fifteen percent of farmers get their capital from other sources such as co-operative societies or informal sources (money lenders).

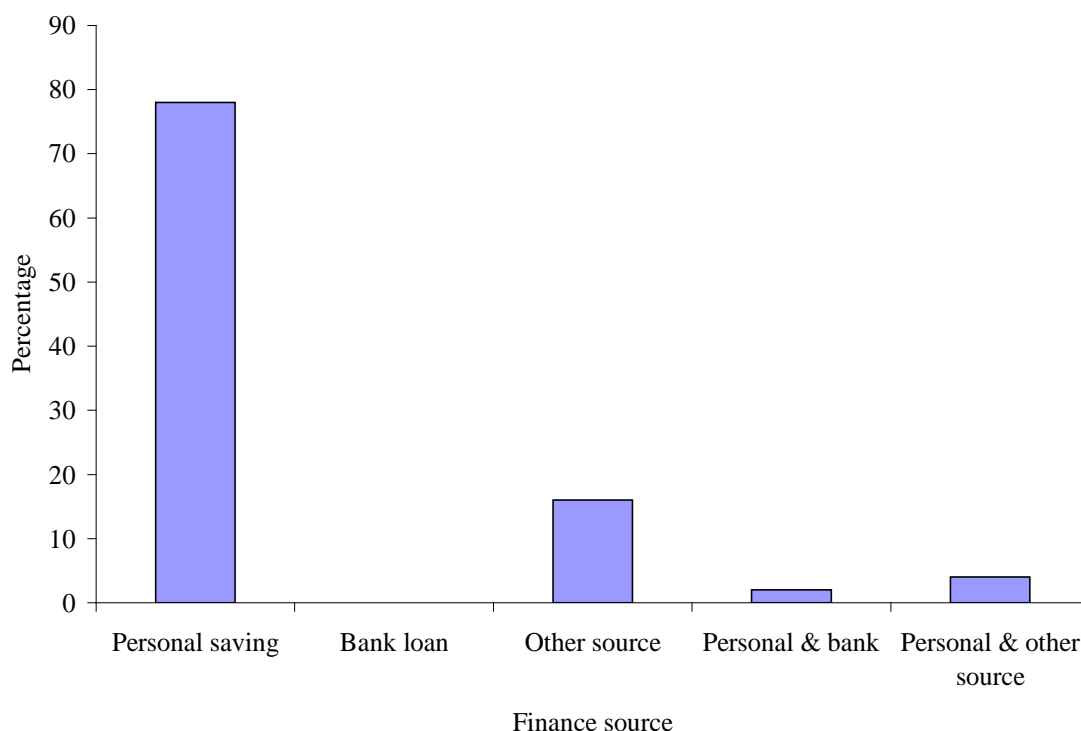


Figure 4.7: Source of finance

4.6 Source of Income

Almost two-thirds of the sampled farmers (60%) reported that income from cocoa production is their sole source of income (Figure 4.8). The remaining 40% of farmers get their income from cocoa production together with another source like carpentry or cultivation of other crops. This suggests that cocoa production can provide a decent standard of living for farmers.

4.7 Weed Control

Hand weeding was found to be the predominant weed control method used in the study area (78%) (Figure 4.9). Only 10% of farmers use herbicides only, while the remaining 12% used both methods. This may be due to the high cost of herbicides, hence it

can be deduced that as far as weed control is concerned organic production can be easily adopted by these farmers as few use herbicides.

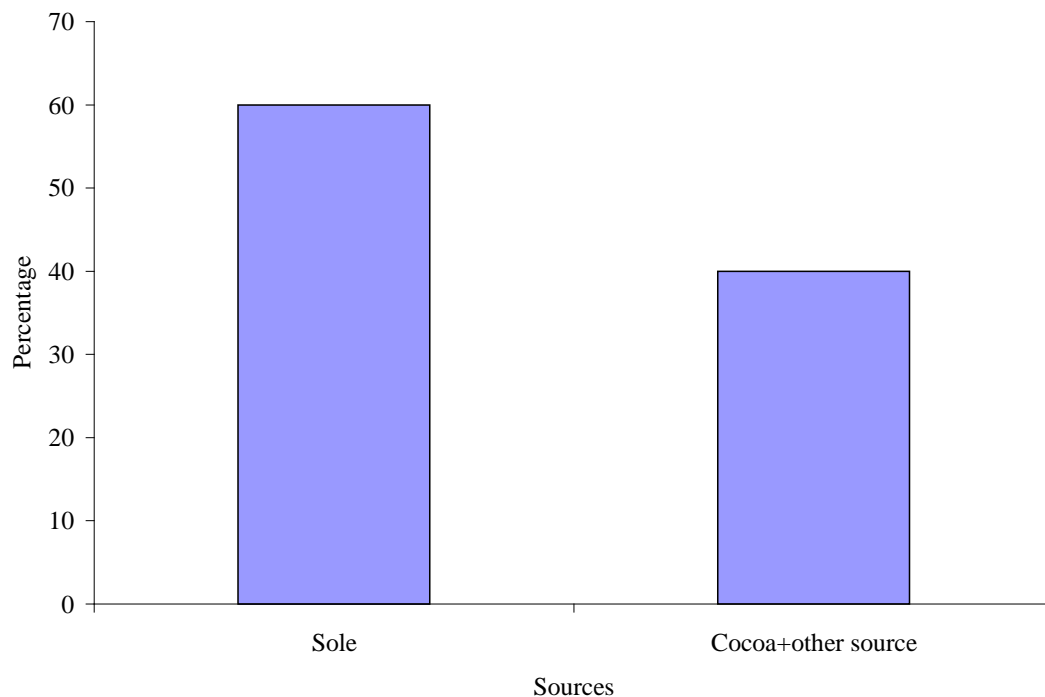


Figure 4.8: Sources of income

4.8 Insect/Pest Control

Farmers in the study area reported that pest infestation is a major problem of cocoa production. Over 90% of the farmers use pesticides on their farms while the remaining farmers use other methods of pest control (cultural practices) or used both methods (pesticides and other methods) (Figure 4.10). It was observed that farmers often use pesticides on their farm before the infestation of the pests as they are always afraid of pest outbreak. In the study area, soluble insecticides such as Capsitox 20 and Diazex 60 EC are used and the predominantly used is Basudin. An average of 4 litres of insecticide was used per hectare of farmland with a price range of ₦ 1000 to ₦1,500⁻¹ litre (£5-£7)

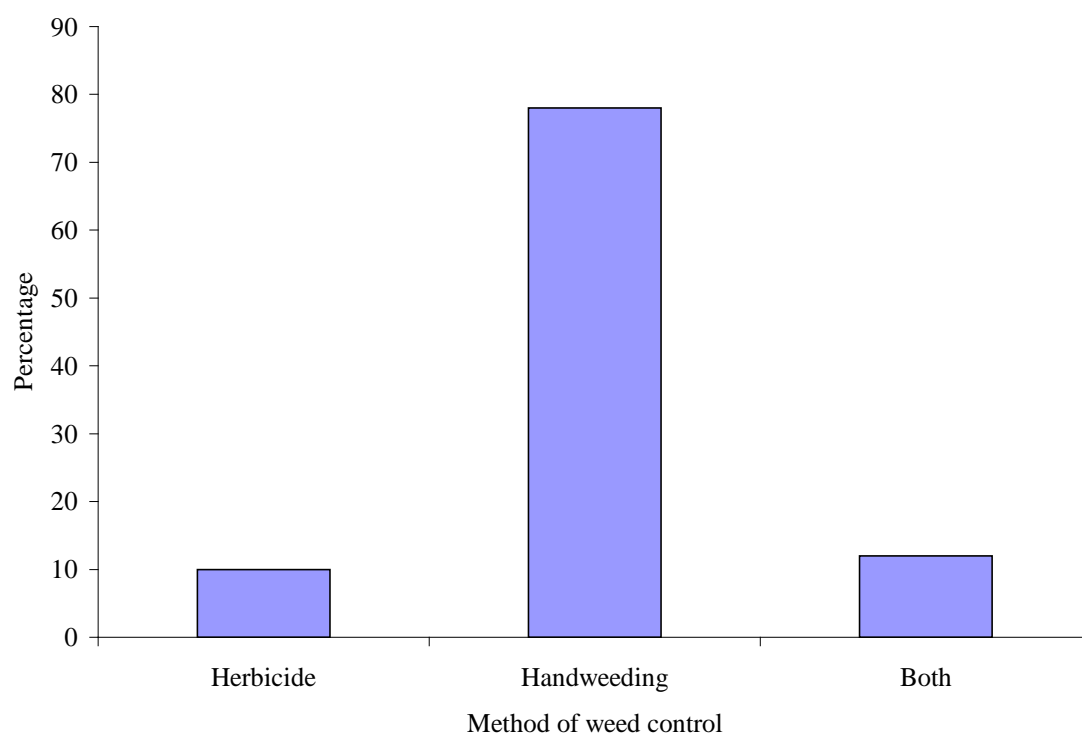


Figure 4.9: Weed control method

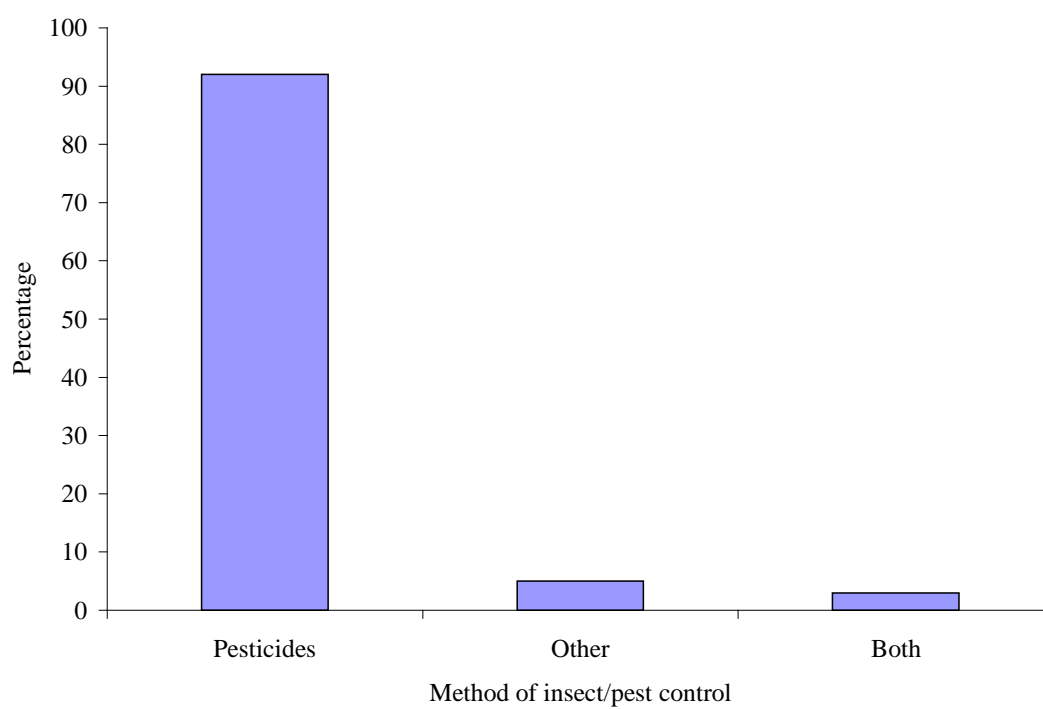


Figure 4.10: Insect control method

4.9 Fungal Control

Black pod disease was found to be the predominant fungal disease in the area. The large majority of the farmers (94%) applied fungicides on their farms while only 6% of the farmers used other methods (Figure 4.11). This implies that for organic production to take place, ways of controlling this disease without the use of agrochemicals need to be developed and adopted. Ridomil plus 72 was found to be the most frequently used fungicide; copper oxide, Pereniox, Lime Bordeaux mixture are also used in the study area. The price ranges from ₦ 100 to ₦ 120 per sachet and between ₦ 3000 to ₦ 3500 per bag. From this study, it was discovered that an average of 150 sachets of Ridomil plus 72 (200 mg) or half a bag of Lime Bordeaux (50 kg) is used per hectare of cocoa farm.

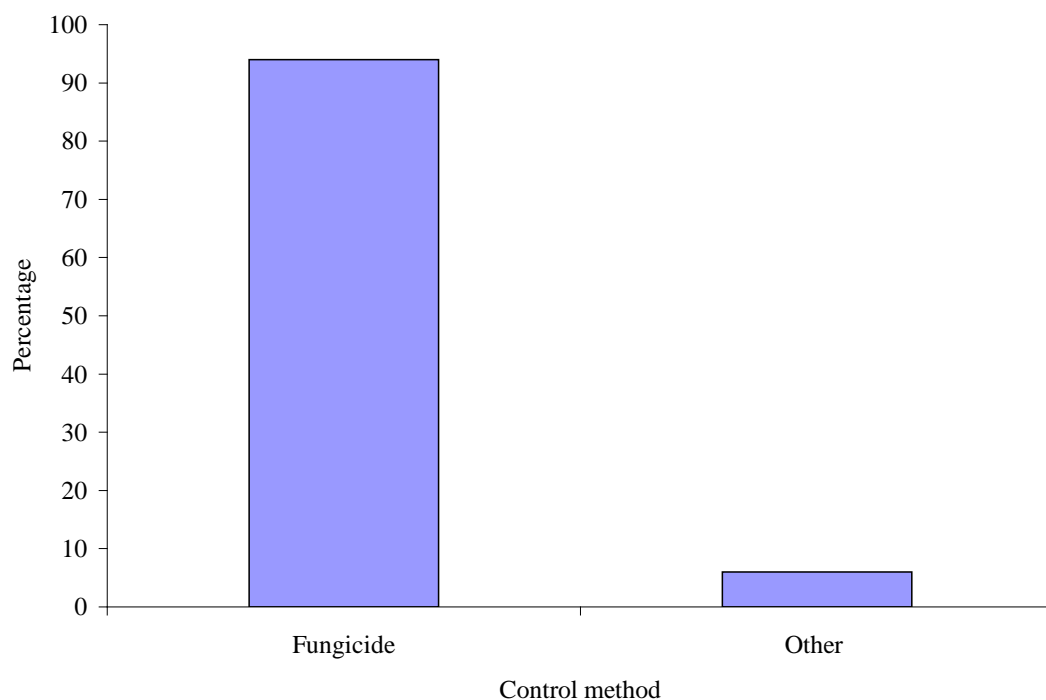


Figure 4.11: Fungal control method

4.10 Fertilizer Application

From Figure 4.12, the majority of the farmers (80%) do not apply fertilizer on their cocoa plantation, this may be due to the fact that cocoa tree litters (it sheds a lot of

leaves) and these leaves add nutrient to the soil. The remaining cocoa farmers (20%) that apply fertilizer on their farms uses fertilizer such as N.P.K 15:15:15 and urea. Since cocoa farmers do not apply fertilizer on their farm, this facilitates organic cocoa production in Nigeria.

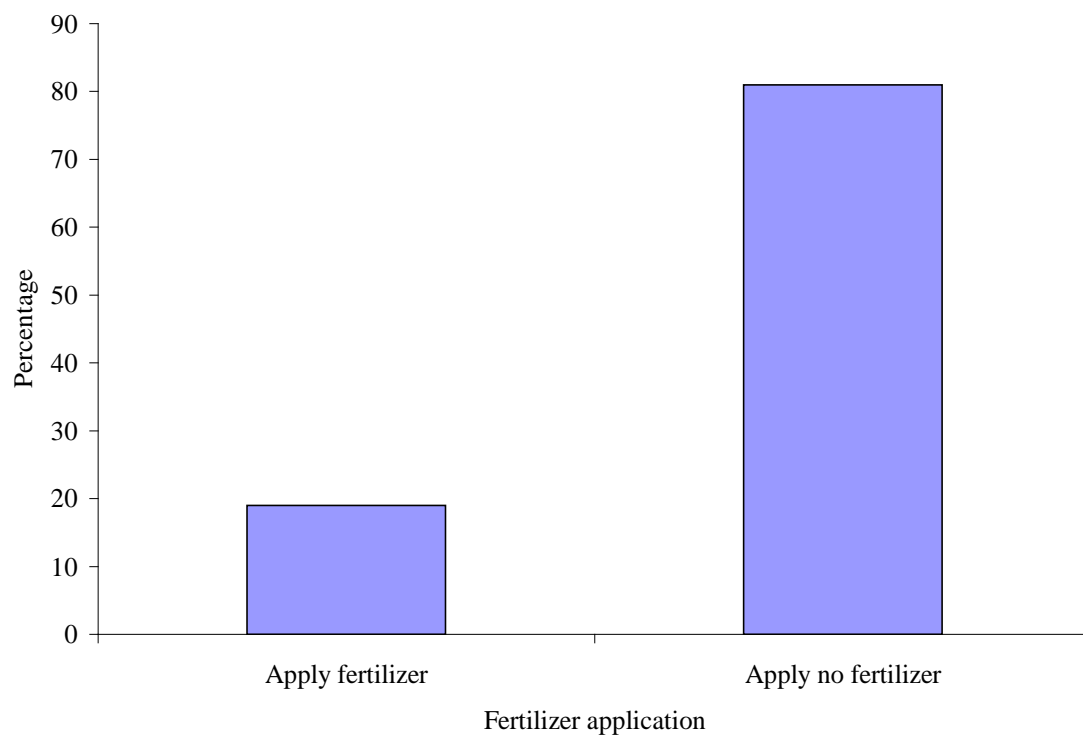


Figure 4.12: Fertilizer application

4.11 Yield per Farm

Eighty six percent of the farmers had a total farm yield of 5 t or less (in this group, yield less than or equal to 1 t had the highest percent of 30%) while 6% had yield ranging from 6 to 10 t and 8% reported that they produce above 10 t (Figure 4.13).

4.12 Yield per Hectare

The majority of the farmers had yields which ranged from 0.61 to 1.0 t ha⁻¹ while less than 5% of the farmers had yield less than 0.4 t ha⁻¹ (Figure 4.14)

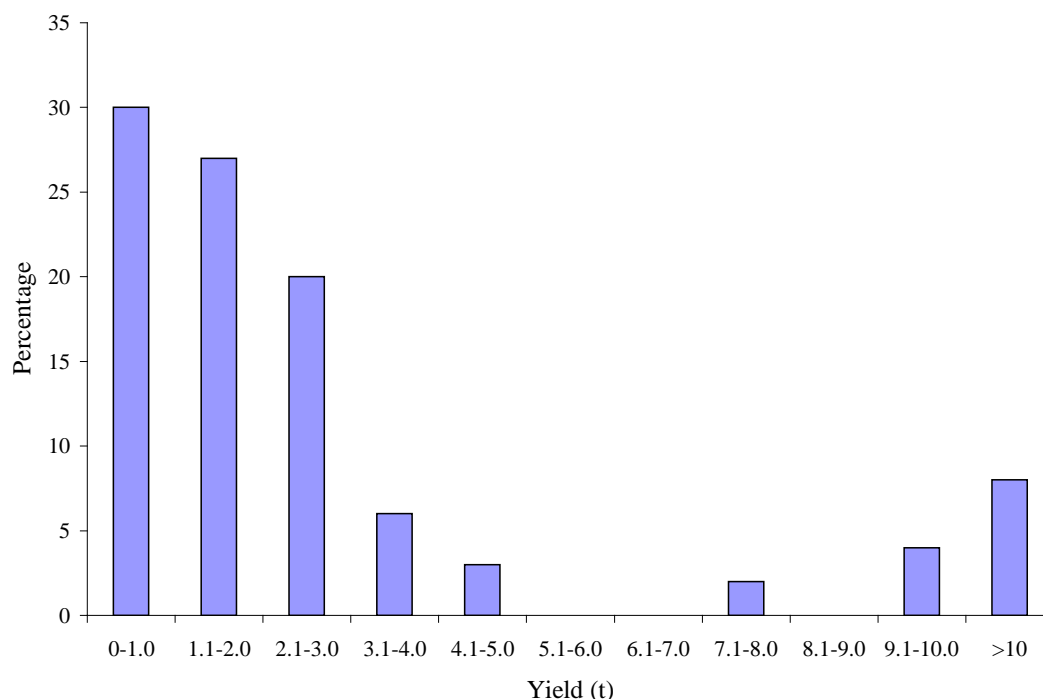


Figure 4.13: Yield distribution

4.13 Production and Marketing Problems of Cocoa

Farmers in the study area experienced problems such as high labour cost, unavailability of labour, lack of capital, insufficient supply of agro-chemicals, price fluctuation, pest and disease infestation, drought and insufficient land for cultivation during production and marketing of cocoa. High labour cost was found to be a major problem facing the farmers in the area.

4.14 Organic Production Awareness

Most of the farmers (79%) reported that they were not aware of organic production methods (Figure 4.15). Of the 21% of farmers who said they had heard of organic production before, most were misinformed. From the survey it was confirmed that most of the 21% of farmers believed organic production means solely not applying inorganic fertilizer but did not know that organic production is a holistic production system.

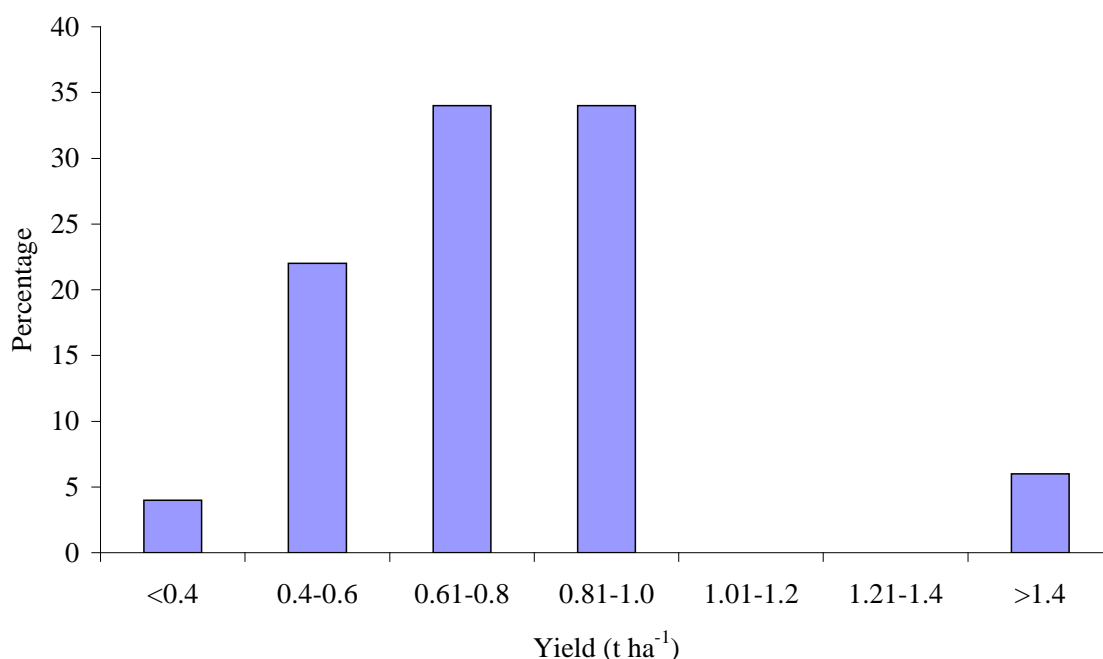


Figure 4.14: Yield per hectare distribution

4.15 Interest in and Willingness to Convert to Organic Production of Cocoa

A large number (94%) of the farmers interviewed were willing to go into organic cocoa production (Figure 4.16). However, the 6% who have no interest in producing cocoa organically believed that it is impossible to produce organic cocoa, and that they are not ready to face the risk. The high percentage of farmers willing to adopt organic agriculture was catalysed by enlightening them on the theory and benefits of organic production. This was done during the questionnaire administration, the researcher told the farmers about organic agriculture production system, its importance, benefits and procedures such as certification and conversion period to be undertaken in order to go into organic production.

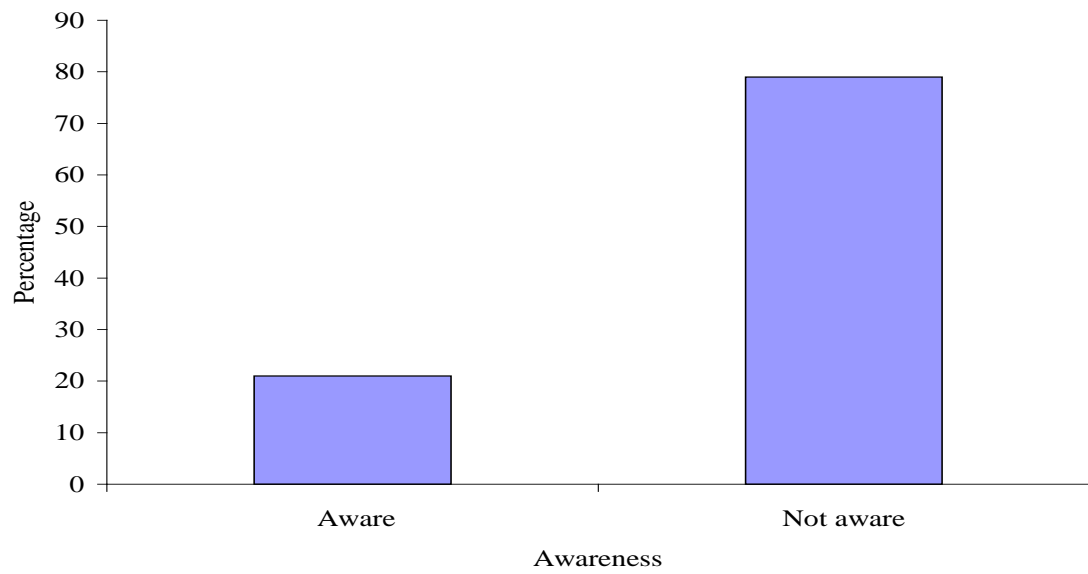


Figure 4.15: Organic production awareness

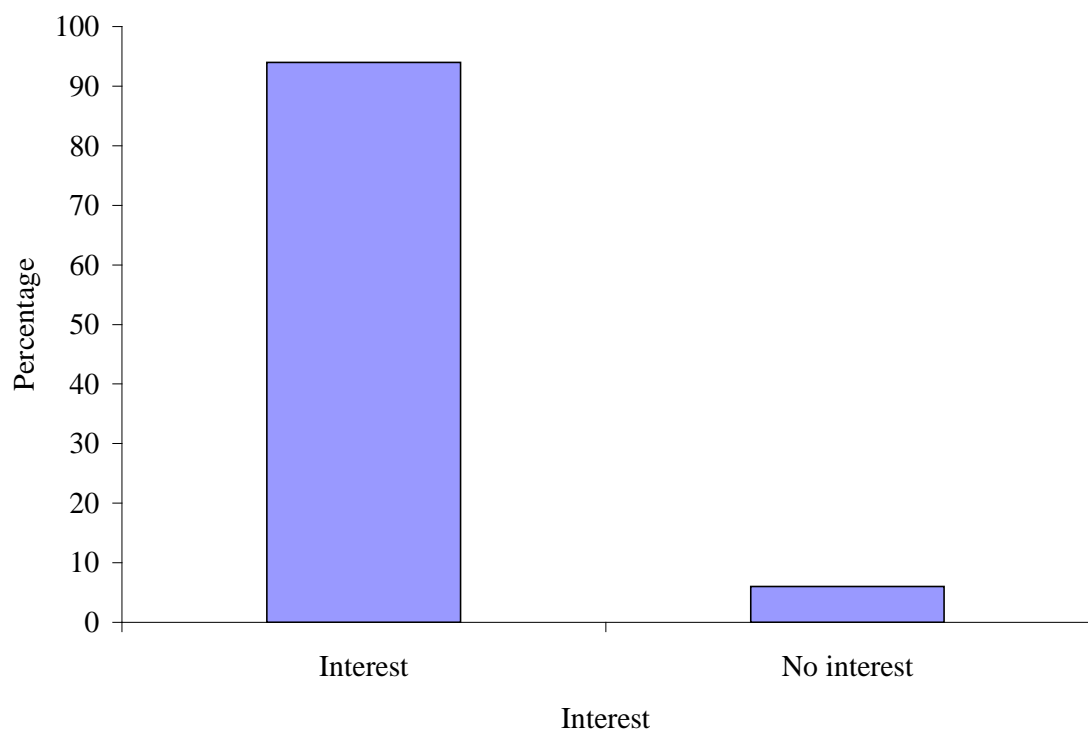


Figure 4.16: Interest/willingness to adopt organic production

4.16 Reasons for Willingness to Adopt Organic Production

The farmers were willing to adopt organic production because of various reasons like reduction in cost of production, increased yield, increased income, and reduced hazards, convenience/easy and safe production method, increased productivity, the traditional way of production and because it is a new innovation that is being recommended by the developed countries (Table 4.1). Majority of the farmers reported income increment and production cost reduction as the major reasons for considering organic agriculture because of the higher premium of organic products to the conventional products.

4.17 Relationship between Farm Size and Yield per Hectare

The correlation between farm size and yield per hectare was estimated at -0.384 $p < 0.01$, (Figure 4.17), this implies that yield per hectare is negatively correlated with farm size (i.e. the higher the farm size the lower the yield per hectare.). Perhaps, this is a result of less stringent management of farms by large scale farmers because of time/ manpower constraints. Small scale farmers can maintain their farms more effectively in comparison.

4.18: Relationship between Yield per Hectare and Farming Experience

The level of farming experience (measured in years) was found to be negatively correlated with yield per hectare -0.218, $p < 0.01$. It is not clear why this is the case, but perhaps older farmers with greater experience are less likely to adopt new practice and innovations but rely more on traditional methods. Figure 4.18 graphically represent the relationship between farming experience and yield per hectare and the R^2 is approximately 5%.

Table 4.1: Reasons for willingness to adopt organic agriculture

Reasons	Frequency (%)
Increase income	58
Reduce cost of production	37
Reduce hazardous effect on both plant and farmers	24
Increase yield/productivity	17
Traditional way of production	15
Easy application	13
Convenience	13
Lack of availability of agro-chemicals	11
As a means to gaining more knowledge on organic production methods	11
Health and safety	9
New technology	5
Organic production is practical and beneficial	4

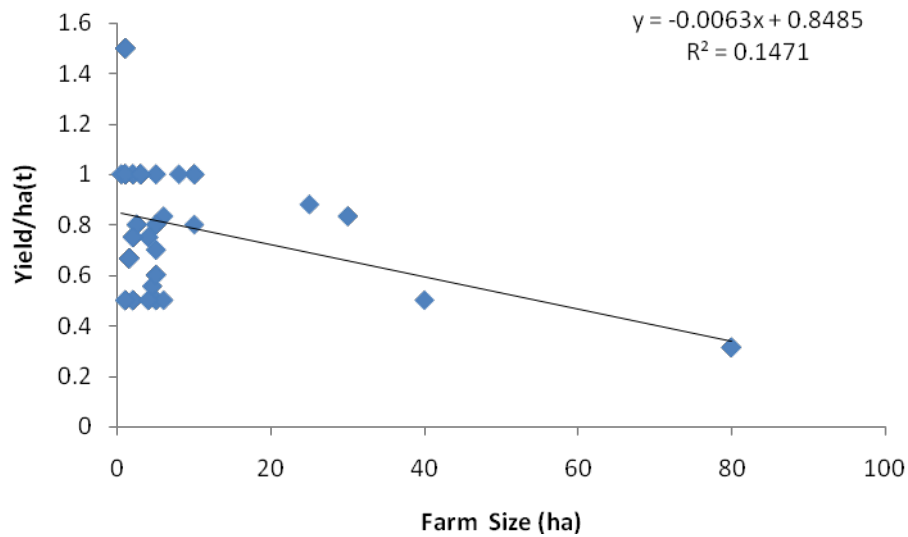


Figure 4.17: Relationship between farm size and yield.

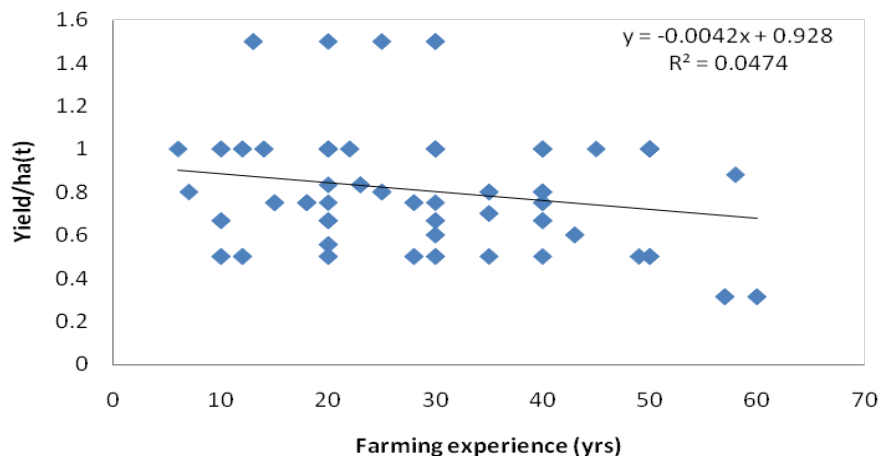


Figure 4.18: Relationship between farming experience and yield

4.19 Effect of Crop Protection Methods on Yield

4.19.1 Effect of Method of Weed Control

Analysis of variance was carried out using Excel to see if there is any difference between yields per hectare among farmers that use different method of weed control.

Table 4.2 summarises the values and variables of yields with the different weed control methods. Table 4.2 and Figure 4.19 show that there no significant differences in yield per hectare between farms employing herbicide and those using only hand weeding, nor between those using herbicides and those using both methods. However, yields were significantly higher on farms using hand weeding than on those using both herbicides and hand weeding.

Table 4.2: Effect of weed control method on yield

	Yield (t ha ⁻¹)		
	Herbicides	Hand weeding	Both
Mean	0.74	0.85	0.53
Standard error	0.025	0.007	0.006
Min	0.31	0.31	0.31
Max	1.00	1.50	0.75
Median	0.77	0.80	0.50
Number of values	10	78	12
ANOVA			

Source of Variation	SS	df	MS	F	P-value	F crit
Weed control method	1.142	2	0.571	9.392	<0.001	3.090
Within Groups	5.901	97	0.0601			
Total	7.044	99				

LSD p=0.05

Comparison	LSD
Herbicide vs Hand	0.164
Herbicide vs Both	0.210
Hand vs Both	0.152

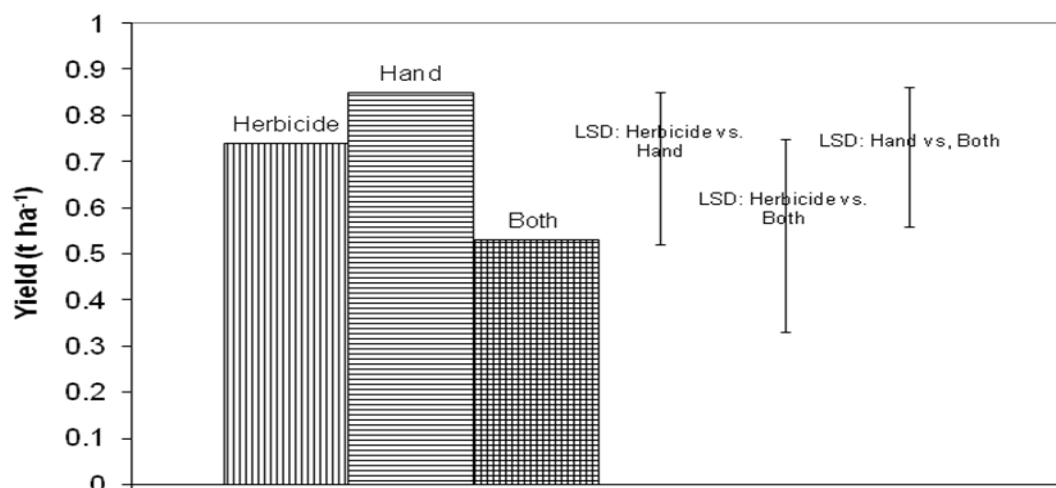


Figure 4.19: Effect of method of weed control on yield of cocoa

4.19.2 Effect of Method of Insect/Pest Control

Similarly, ANOVA was carried out to see if there is any difference between yields per hectare among farmers that use different method of insect/pest control. Table 4.3 summarises the values and variables of yields with the different insect/pest control methods.

Table 4.3 and Figure 4.20 show that there no significant differences in yield per hectare between farms that apply insecticides and those that use both methods, nor between those applying insecticides and those using other methods. However, yields were significantly higher on farms employing other and both methods.

4.19.3 Effect of Method of Fungal Control

Likewise, ANOVA was carried out to see if there is any difference between yields per hectare among farmers that use different method of fungal control. Table 4.4 summarises the values and variables of yields with the different fungal control methods.

Table 4.3: Effect of insect/pest control method on yield

	Yield (t ha ⁻¹)		
	Insecticides	Other methods	Both
Mean	0.80	0.94	0.52
Standard error	0.008	0.003	0.028
Min	0.31	0.83	0.31
Max	1.50	1.00	0.75
Median	0.78	1.00	0.50
Number of values	92	5	3
ANOVA			

Source of Variation	SS	df	MS	F	P-value	F crit
Weed control method	1.142	2	0.571	9.392	<0.001	3.090
Within Groups	5.901	97	0.0601			
Total	7.044	99				

Comparison	LSD
Insecticides vs Other	0.240
Insecticides vs Both	0.306
Other method vs Both	0.381

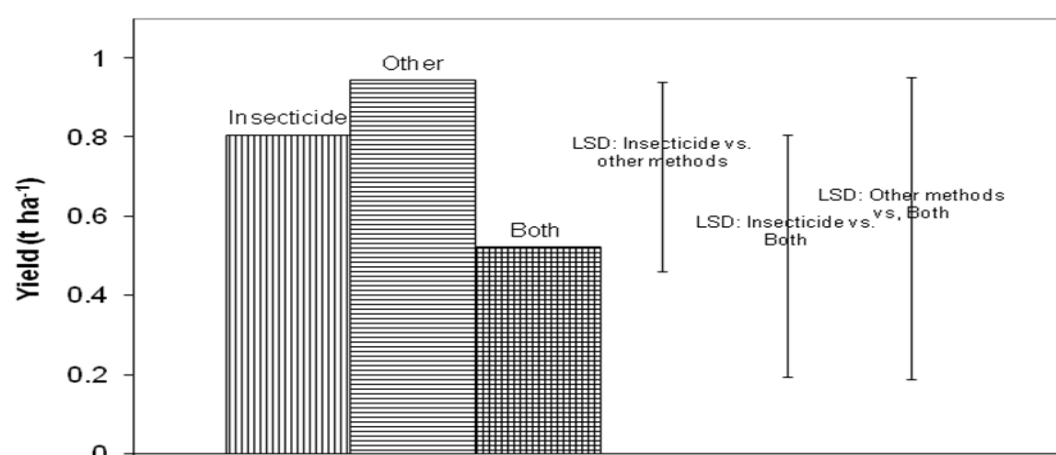


Figure 4.20: Effect of method of insect/pest control on yield of cocoa

Table 4.4 Effect of fungal control method on yield

	Yield (t ha ⁻¹)	
	Fungicides	Other methods
Mean	0.82	0.58
Standard error	0.007	0.017
Min	0.31	0.50
Max	1.50	1.00
Median	0.80	0.79
Number of values	94	6

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Fungal control method	0.307	1	0.307	4.463	<0.037	3.938
Within Groups	6.738	98	0.069			
Total	7.044	99				

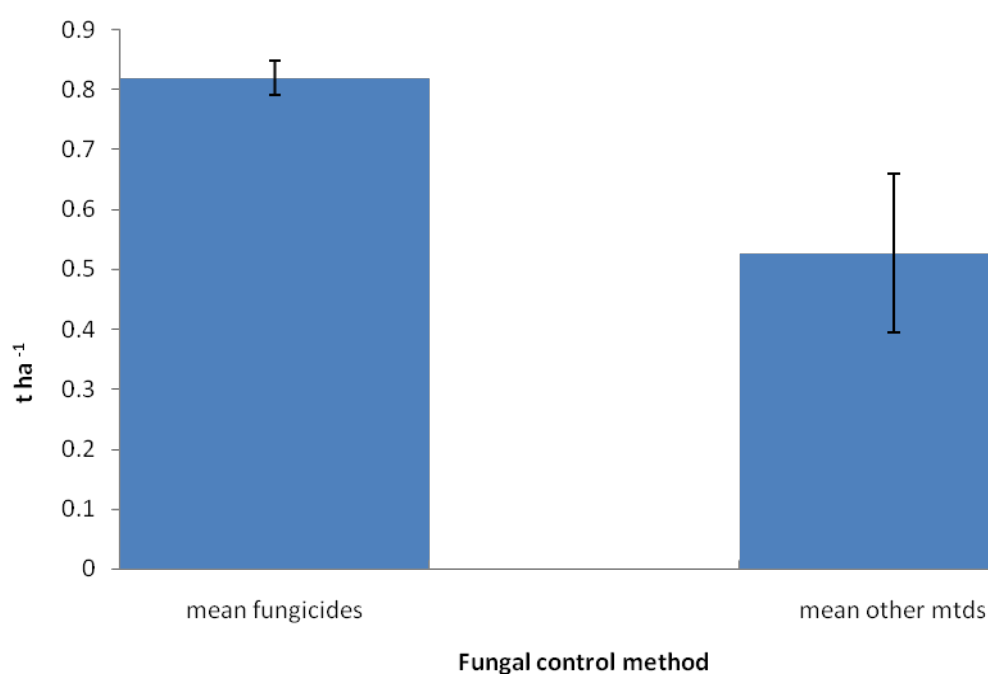


Figure 4.21: Effect of method of fungal control on yield of cocoa

Since there is only one comparison, LSD was not necessary; hence the result of the ANOVA was used to deduce that there was a significant difference between the use of

fungicides and other methods. This may be because farmers apply fungicides as a preventive measure and not as curative measures or because of the small sample size of those cocoa farmers that use other methods of fungal control.

CHAPTER FIVE

ECONOMIC ANALYSIS OF CONVENTIONAL AND ORGANIC COCOA PRODUCTION IN SOUTH-WESTERN, NIGERIA

This chapter analyses the economics of cocoa production in the study area, to see if organic cocoa production is economically viable in South-Western Nigeria. A number of economic variables including total revenue (TREV), total variable cost (TVC) and gross margin (GM)) of the farmers were determined. The currency used in all calculations is the Nigeria currency (Naira). The exchange rate used for this calculation was ₦ 218.75 to £1.

5.1 Economics of Conventional Cocoa Production

5.1.1 Total Revenue (TREV) of Cocoa Production in the Study Area

The total revenue of the conventional cocoa farmers was estimated using SPSS software. The total revenue considered in this study comprises income from cocoa production only. The average total revenue was calculated by multiplying the average yield (in tonnes) by average unit price per tonne of Nigeria conventional cocoa. In the study area, cocoa farm gate price varies, ranging from ₦160,000 to ₦300,000 per tonne and the average price was estimated at ₦202,750, thus this average price was used in estimating the total revenue

Table 5.1: Average total revenue

	Number of farmers	Mean (Naira)
Total revenue	100	844,575

From Table 5.1 above, the average total revenue of the farmers in the study area is ₦ 844,575 and the total revenue ranges from ₦ 50,000 to ₦ 5,000,000.

5.1.2 Total Variable Cost (TVC) of Conventional Cocoa Production in the Study Area

From the survey, the variable costs incurred by the farmers are labour costs, the cost of agro-chemicals (pesticides/insecticides, fertilizer, herbicides), harvesting cost, other costs. Variable costs vary from farmer to farmer and the average variable cost is estimated at ₦355,629. Labour cost was found to be the highest variable cost ranging from ₦2,000 to ₦5,000 per labour per farm operation. The table below shows the average total variable cost incurred in conventional Nigeria cocoa production.

Table 5.2: Average total variable cost for conventional cocoa production

Variables	Cost (₦)
Labour	34,910
Cost of agro-chemicals	295,914
Harvesting	24,080
Others (this comprises miscellaneous cost incurred on the farm that is not categorised in the mentioned cost, e.g. cost of transportation of farmers to the farm)	725
Total	355,629

5.1.3 Gross Margin for Conventional Cocoa Production (GM) in the Study Area

The gross margin was obtained by subtracting the total variable cost from the total revenue of estimated for the production cocoa. The average gross margin from the conventional cocoa production in South-western Nigeria was estimated at ₦ 488,946.

5.2 Economics of Organic Cocoa Production

As there is no organic cocoa production in Nigeria, yield of conventional cocoa farmers was used to estimate organic. In the first instance, this study assumed the same yield for the proposed organic cocoa production and conventional cocoa production as studies such as (Steffen *et al.* 1995) shows that organic crop can produce equal or outperform the yield of conventional production. Furthermore, in order to get accurate results as well as avoiding bias, this study did a sensitivity analysis in which changes in yield (decrease or increase) were assumed at different prices of organic cocoa. Different prices of organic cocoa were calculated by estimating farm-gate price of conventional cocoa in Nigeria, Ghana and Ivory Coast bearing in mind the ranges in organic premium (\$100-300 higher than the conventional price). The Uganda organic cocoa price was also used by this study. The cost of certification charged by Soil Association UK is estimated at £701.4 for 50 ha or less (Lampkin, Measure, and Padel 2002). The currency was converted to Naira at the official (CBN) exchange rate £1 = ₦ 218.75. Soil Association certification cost was used because this study aims at encouraging the production and exportation of organic cocoa to the European market. Similarly, this study assumed that there was no application of organic fertilizer as it was observed in the conventional production that very few farmers apply fertilizer on their farm.

5.2.1 Total revenue (TREV) using Nigeria Farm Gate Price

The total revenue of organic cocoa farmers was also estimated using SPSS software. The farm gate price of Nigerian conventional cocoa was used to estimate the price of organic cocoa. The calculated average farm-gate price in the study area as stated earlier is ₦ 202,750. The price for organic cocoa is said to be \$100-300 per tonne higher than the conventional price. Thus organic cocoa price was calculated bearing

in mind the organic premium range, average price of organic cocoa was estimated as ₦214,343 and ₦237,531 at the lower and higher organic premium respectively. These estimated prices of organic cocoa were then used to calculate the total revenue of organic cocoa. From Table 5.3, the estimated average total revenue for organic cocoa is between ₦ 893,812 and ₦ 990,502

5.2.2 Total revenue (TR) using Ugandan Organic Cocoa Price

Mesure (2007) stated the farm-gate price of organic cocoa in Uganda to be US\$ 3,000,000 per tonne, thus, this study used the Uganda organic cocoa price to calculate the total revenue by multiplying the average price of Ugandan organic cocoa price and average yield of the estimated Nigeria conventional cocoa production. This study assumed that the same yield of Nigeria conventional cocoa as the proposed organic cocoa production, thus total revenue of the proposed organic production is estimated at ₦ 736,239.

5.2.3 Total Revenue (TR) using Ghana Farm-Gate Price of Conventional Cocoa

In Ghana, conventional cocoa price is 1632 Cedis per tonnes (\$1378.42) (Pana 2008); this price was then used to estimate the price of organic cocoa. Using the lower premium of organic cocoa \$100, organic cocoa price was calculated to be ₦ 181,624.23 and at the higher premium, it was calculated as ₦ 220,181.50. Similarly, using the Ghana situation, this study assumed the price of Ghana organic cocoa to be the same with the proposed Nigeria organic cocoa production. The calculated Ghanaian organic cocoa prices were used to estimate total revenue of organic cocoa which is shown in Table 5.3.

5.2.4 Total revenue (TR) using Ivory Coast Farm-Gate Price of Conventional Cocoa

Ivory Coast farm-gate price for conventional cocoa is 700,000 CFA (Bruce 2008).

This was also used in this study to calculate organic cocoa price. The lower and the higher organic cocoa price were calculated as ₦181,901 and ₦220,438 respectively, the total revenue is presented in Table 5.3. From the table Uganda has only one value of total revenue as this study was able to get the price of organic cocoa production in the country.

Table 5.3 Total revenue (TR) using the various country farm-gate prices

	Total revenue at lower price range (₦)	Total revenue at higher price range (₦)
Nigeria	893,812	990,502
Ghana	757,373	918,157
Ivory Coast	758,526	919,226
Uganda	736,239	

5.2.5 Total Variable Cost (TVC) of Organic Cocoa Production

Farm variable costs include labour costs (hand weeding), certification costs, harvesting cost and others. Table 5.4 presents the various variable costs of organic cocoa production.

Table 5.4: Average total variable cost for organic cocoa production

Variables	Cost (₦)
Labour	34910
Certification	153,431
Harvesting	24,080
Others	726
Total	213,147

The total variable cost for organic cocoa production is lower than the conventional cocoa production as the cost of agro-chemical is eliminated or reduced.

Several studies have shown organic farming systems to require an increase in labour cost. In the initial calculations, this study assumed that the same labour cost is incurred in both conventional and in the proposed organic cocoa production in order to estimate the total variable cost of organic production. However, in Section 5.5, a sensitivity analysis was carried out in which the effect was tested of increasing or decreasing the labour cost at different levels of organic premium.

5.2.6 Gross Margin for Organic Cocoa Production using the Various Total Revenues

The gross margin was obtained by subtracting the total variable costs from the total revenue of the proposed organic cocoa production. Different gross margin were obtained using the different estimated total revenue but the same variable cost was used. Table 5.5 shows the different gross margin. It can be deduced from this findings that organic cocoa production is profitable.

Table 5.5: Gross margin using different country organic prices. (N.B, Gross margin Nigerian conventional cocoa is ₦488, 946)

	Nigeria lower price limit (₦)	Nigeria higher price limit(₦)	Uganda (₦)	Ghana lower price limit (₦)	Ghana higher price limit(₦)	Ivory Coast lower price limit (₦)	Ivory Coast higher price limit(₦)
Total Revenue	893,812	990,502	736,239	757,373	918,157	758,526	919,225
Variable cost	213,147	213,147	213,147	213,147	213,147	213,147	213,147
Gross margin	680,666	777,355	523,093	544,227	705,010	545,379	706,079

Comparison of the total revenue, total variable cost and gross margin between conventional and organic cocoa production was done. The percent difference in total variable cost (TVC) between organic and conventional cocoa production was not included in the Table 5.6 because this study as an empirical study used the same total variable cost for all the different organic prices and is estimated at -40% implying that the total variable cost of the proposed organic cocoa production is 40% lower than the Nigerian conventional cocoa production. Table 5.6 presents the various estimated total revenues and gross margins of organic production ranging from -13% to +17% compared with conventional Nigerian production for total revenue. The total revenue of the proposed organic cocoa production is lower than with the Nigerian conventional production when applying the lower price estimate current in Uganda, Ghana and Ivory Coast but higher when applying the upper price. The gross margin for the proposed organic cocoa production when applying either the upper or lower price current in all the countries is higher than Nigerian conventional cocoa ranging from +7 to +59%. This is in conformity with the study carried out DIIS (2007).

Table 5.6: Comparison of total revenue (TR) total variable costs (TVC) and gross margin (GM) between conventional and organic cocoa production.

Country	TR	TVC	GM	TR	GM
Nigeria conventional	844,575	355,629	488,946		
Organic premium price (₦)				Potential difference in proposed organic cocoa and Nigerian conventional cocoa production	
Nigeria lower	893,812	213,147	680,665	+5	+39
Nigeria higher	990,502	213,147	777,355	+17	+59
Uganda	736,239	213,147	523,093	-13	+7
Ghana lower	757,373	213,147	544,226	-10	+11
Ghana higher	918,157	213,147	705,011	+9	+44
Ivory cost lower	758,526	213,147	545,379	-10	+12
Ivory coast higher	919,226	213,147	706,080	+9	+44

5.3 Changes in Yield

A sensitivity analysis was done to determine the effect of changes in yield on the profitability of organic cocoa production using the yield of conventional cocoa production in the study area as the control yield. The estimated price of organic cocoa obtained for Nigerian conventional cocoa was used in calculating the total revenue and gross margin bearing in mind the organic premium ranges. Table 5.7 shows organic cocoa production in Nigeria to be more profitable than conventional at the maximum organic price premium even if yield decreased by 50%. Organic cocoa production is more profitable than conventional at the same yield and increasingly more profitable if organic production can increase yield. However, organic cocoa production becomes less profitable than conventional at the lower premium price if yields decrease by 25%. Therefore, Nigerian cocoa farmers willing to go into organic cocoa production should ensure they produce yield if not higher than the average conventional cocoa yield is at least equal to the conventional production.

5.4 Changes in Organic Premium

From Table 5.8, using the price of conventional cocoa in Nigeria, gross margin of the proposed organic cocoa production was higher than the conventional Nigerian cocoa production variables at no organic premium and at range of \$50 to \$300 organic premium assuming same yield of the conventional cocoa is produced. Implying that production of organic cocoa is more profitable than conventional cocoa production even at no organic premium. Hence, farmers should ensure they do not sell their proposed organic cocoa less than the price of conventional cocoa.

5.5 Changes in labour Cost

Table 5.9 shows the comparison between the various parameters of profitability with changes in labour cost (decrease or increase). This study used different percentage

decrease/ increase in labour cost. Organic cocoa production was found to be more profitable at every level of labour cost level. Surprisingly, organic production was found to be profitable even at the highest percentage increase of labour cost. This can be due to the fact that high labour cost is not commensurate with the high cost of agro-chemical used on conventional cocoa produce.

5.6 Expected yield of proposed organic production to be profitable as Nigerian conventional cocoa production.

This study attempted to determine expected yield of the proposed organic cocoa production for it to be profitable as Nigerian conventional cocoa production. Table 5.10 presents the different yield that must be produced at no organic premium and different organic premiums. From the table, organic cocoa farmer need to produce 3.46 t of organic cocoa (which is 16.9% less the average conventional yield of 4.17 t) in order to get same profit as the conventional production. Interestingly, the expected organic cocoa yield decreases along with an increase in organic premium (19.2%, 21.4% and 29.0% at \$50, \$100 and \$300 per ton organic premium respectively. This implies that a farmer who wants to produce organic cocoa can afford to produce 29% less than the conventional cocoa yield and still make the same profit as with conventional production if his organic cocoa is sold at \$300 per tonne organic premium.

5.7 Expected labour cost of proposed organic production to be profitable as Nigerian conventional cocoa production.

Similarly, this study attempted to determine the amount of labour cost an organic cocoa farmer can incur and still be as profitable as the conventional cocoa farmer. Table 5.11 shows the extra labour cost that can be incurred and organic cocoa production will still be as profitable as the conventional. From this table, the organic cocoa production can still be as profitable as the conventional even if the labour cost is four times higher (408%) than the average labour cost. Labour costs of organic production that could be incurred and still remains as profitable as conventional cocoa was found to increase with increase in organic premium (480%, 549% and 829% at \$50, \$100 and \$300 per ton organic premium, respectively). Hence, a farmer can decide to double the number of labourers as well as double the wages of the labourers or increase the wages of labourers four times and still be as profitable as conventional production if the same yield is produced with no organic premium.

Table 5.7 Comparison of total revenue (GM) at different percentages of yield using the minimum and maximum organic premium (N.B Nigerian conventional cocoa gross margin is estimated at ₦488,946)

	Percentage decrease in yield						Percentage increase in yield					
	25%		50%		75%		25%		50%		75%	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Total revenue (₦)	670,359	1,132,673	446,906	755,115	223,453	377,557	1,117,265	1,887,788	1,340,719	2,265,346	1,564,171	2,642,903
GM (₦)	457,213	919,527	233,760	541,969	10,307	164,412	904,119	1,674,642	1,127,573	2,052,000	1,351,026	2,429,757

Table 5.8: Comparison of gross margin using different organic premium prices

	0(\$)	50(\$)	100(\$)	150(\$)	200(\$)	250(\$)	300(\$)	350(\$)
TR (₦)	844,575	869,639	893,812	917,984	942,157	966,329	990,502	1,014,675
GM(₦)	631,428	656,492	680,665	704,837	729,010	753,182	777,355	801,528

Table 5.9 Comparison of total revenue (TR), total variable cost (TVC) and gross margin (GM) at the minimum and maximum organic premium with at different levels of labour cost (N.B Nigerian conventional cocoa gross margin is estimated at ₦488,946)

	Percentage decrease in labour cost								Percentage increase in labour cost							
	25%		50%		75%		100%		25%		50%		75%		100%	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
TR(₦)	893,812	990,502	893,812	990,502	893,812	990,502	893,812	990,502	893,812	990,502	893,812	990,502	893,812	990,502	893,812	990,502
TVC(₦)	203,769	203,769	195,041	195,041	186,313	186,313	177,586	177,586	221,223	221,223	229,951	229,951	238,679	238,679	247,406	247,406
GM(₦)	690,043	786,733	698,771	795,461	707,499	804,189	716,226	812,916	672,589	769,279	663,861	760,551	655,134	751,824	646,406	743,096

Table 5.10: Expected yield at different organic premium per tonne making proposed organic cocoa production as profitable as Nigerian conventional cocoa production. (N.B mean yield is 4.17 t)

	No organic premium	\$50 organic premium	\$100 organic Premium	\$300 organic premium
Expected Yield (t)	3.46	3.37	3.28	2.96
Percentage difference in yield (%)	16.9	19.2	21.4	29.0

Table 5.11: Expected labour cost at different organic premium per tonne making proposed organic cocoa production profitable as Nigerian conventional cocoa production. (N.B labour cost is ₦34,910)

	No organic premium	\$50 organic premium	\$100 organic Premium	\$300 organic premium
Expected Labour cost (₦)	142,482	167,546	191,719	288,409
Percentage difference in labour (%)	408	480	549	826

CHAPTER 6 – DISCUSSION AND CONCLUSION

Chapter Six reflects on the extent at which the research objectives and aims were achieved following the result presentation in Chapters 4 and 5. The chapter contain the major findings of the study, conclusion, recommendation and suggestion for other studies. The major problems encountered by Nigeria cocoa farmers were discussed and relevant solutions were provided. Similarly Nigerian Cocoa Farmers' Willingness to Adopt Organic Cocoa Production, Method of Weed Control, Research Methodology and Profitability of Potential Organic Cocoa Production in South-Western Nigeria were also discussed in this chapter

6.1 Discussion

6 .1.1 Problems of Production and Marketing of Conventional Cocoa

The questionnaire data shows that Nigerian conventional cocoa farmers encountered several problems in the production and marketing of their products. These problems vary from farmer to farmer and location but most of the farmers have major problems which are common to all. These major problems include high labour cost, unavailability of labour, lack of capital, insufficient supply of agro-chemicals, price fluctuation, pest and disease infestation, unfavourable climate change (drought) and insufficient land for cultivation.

High labour cost is a predominant problem in cocoa production; this has been the major problem of all kinds of farmers but is more particular to cocoa production owing to its life cycle (perennial crop) and size of farmland. Cocoa production involves little or no skill, thus making it not to require any special labour (skilled or semi-skilled labour) but only require availability and adequacy of labour. In this

study, it was observed that older people are involved in cocoa production and this results in high labour cost as young people that are productive are not willing to go into cocoa production as they see cocoa production as not being as lucrative as other jobs like white colour jobs and handcraft jobs. Similarly, people are not encouraged to go into cocoa production owing to the long maturing time of the cocoa tree. They find it difficult to wait for the maturing time as it is seen as a waste of time causing them to opt for other crop production thus facilitating high labour cost as the limited labour available tends to charge high rates in the absence of competition.

Furthermore, as cocoa is a perennial crop it takes time before the farmers get their profit and labourers tends to charge higher rates as they know that there might be delay or lateness in their payment. Also in cocoa production, labour is hired on annual/ production season basis and not on hourly or man-day basis hence labourers tend to charge a higher rate on estimation i.e. since the labourers cannot calculate the number of their working hours in a production season, they charge on estimate (which may be higher or lower). Similarly, in cocoa production, the same labourers are hired to carry out the whole production activities including weeding, planting, application of agro-chemicals, harvesting and post harvesting operations. The labourers overcharge the farmers by assuming the cost for each production activity and thus charging the cocoa farmer a cumulative/summative labour cost. Whereas, if labour is paid separately for each production activities, it may not be as high as the cumulative/summative cost of all the production activities

In addition, from the study, some cocoa farmers practise a mixed cropping system where cocoa is planted with other crops (yam, cocoyam, citrus, cashew etc).

Labourers that work on the farmland charge higher as they believe they are working on a land having two different crops with different production activities that demand more time and energy. This problem has been partially tackled by using family labour as a complement and mechanisation. High labour cost can also be solved by having a standard or controlled wage (man-day) for labour, as this will help the farmers as well as the labour in terms of bargaining power. If a labourer charges a farmer a very high amount and if the labourer has a higher bargaining power than the farmer, he tends to exploit the farmer and vice versa.

Insufficient supply and cost of agro-chemical is another dominant problem of cocoa production; farmers have access to limited supply of agro-chemical which invariably affects production. In the 1990s with the implementation of the Structural Adjustment Programme in Nigeria, the problem was solved to an extent as the World Bank funded the programme by subsidising chemical usage. However, this brought its own challenges as Nigerian farmers rarely still can afford these products even at a subsidised price. Furthermore, the agro-chemicals were not readily available as their supply was not well handled by the Nigerian government. Hence organic cocoa production serves as an attractive alternative as farmers need not worry about cost or availability of agro-chemicals. Furthermore, adoption of organic cocoa production will allow a reduction in production costs which leads to improved standard of living of the farmers.

Insufficient land for cultivation is another problem facing Nigerian cocoa farmers. Evidence from this study shows that most cocoa farmland is inherited, making it difficult for someone that is not from cocoa producing communities to go into cocoa

production. Furthermore, it may be slightly difficult for someone from cocoa producing community who has an interest in cocoa production to do if he/she is not an heir of the family as it is believe in Nigeria that the heir/ favourite / the eldest person inherit the family land.

The migration of people to less populated areas has an effect on cocoa production in Nigeria. Lands that are supposed to be used for cocoa production have been converted to residential thus discouraging cocoa production in Nigeria. Similarly, the springing up of industries and factories also affects cocoa production. Lands that were used for cocoa production are now where factories are built. In Nigeria, fallow land is being taken as government property where social facilities such as schools, hospitals and stadiums are built. Thus, anybody that wants to use the land needs to seek the consent of the government, thus discouraging the existing or potential cocoa farmers. In solving this problem, the government has a vital role to play in ensuring that some land are allocated for agriculture and these lands are not used for any other things. Also, people should be enlightened to lease, rent or sell their land once the buyer meets the requirement for the sale of the land and not to be sentimental about family land.

Insufficient capital is another problem of Nigerian cocoa farmers, from the result of this study, 76% of the farmers interviewed use their personal savings as capital. The problem in this is that farmers personal saving are small relative to the funds needed in cocoa production. Hence, farmers produce at a small scale that their personal saving can cover or borrow money from other sources such as money lenders at a high interest rate. From the study, it was observed that none of the farmers

interviewed get loans solely from banks implying that the Nigerian government is not encouraging agriculture especially cocoa production despite the high revenue derived from the export of cocoa. To rectify this problem, there should be creation of more agricultural banks such as the Nigerian Agricultural Credit and Rural Development Ltd (NACRDB). NACRDB gives loans ranging from smallholder loans to large-scale or investment loan schemes and on lending scheme. Likewise, the capital share given by the Federal Government to the Agricultural Credit Guarantee Scheme Fund (ACGSF) and Small and Micro Enterprise (SMES) should be increase and monitored to ensure that that the loans goes to the target clients (farmers) and to ensure that the loans are effectively used by the farmers.

In interviewing cocoa farmers, climate change especially drought is another problem cocoa farmers encountered. Drought is a natural phenomenon that cannot be controlled by man. This study suggests that a variety of cocoa that is resistant to drought should be planted and cocoa plantations should be sited very close to water supplies such as rivers.

Disease and pest infestation are other examples of the problems facing cocoa farmers. Black pod disease is the predominant disease facing cocoa farmers in developing countries (ICCO 2007). In Ghana, the problem was tackled by planting cocoa under the shade of indigenous tress such as pineapple, coffee or banana. Cocoa planted under these conditions had no need for pesticide spraying. Similarly, the planting of resistant varieties and traditional practices including the reduction of relative humidity within cocoa canopy by pruning in order to improve air circulation, have been successful methods employed by Ghanaian organic cocoa farmers. Likewise the

removing and burning of trees infested with cocoa swollen shoot virus has been a success story since 1963 in Ghana. Furthermore, Ghanaian organic cocoa farmers also adopted biological pest management using mealy bug farming ant to reduce capsid damage on cocoa trees. All these solutions used in Ghana should be easily adapted to the Nigerian situation since the two countries are within the same agro-ecological zone.

Price fluctuation is a major occurrence in cocoa production as middle men not cocoa farmers determine the price of the product. The issue of the middle men has been a major concern in marketing. The middle men dictate the price that favours them as they are the link between the producer and the consumers making it difficult for the producer to bypass them as the middlemen know the market and are able to sell the product. The middlemen also exploit cocoa farmers by telling them that their cocoa beans are of a lower grade level (inferior). This makes cocoa farmers sell their cocoa beans at lower prices. Cocoa bean is graded into two categories: Grade A cocoa beans have no impurities, no non-fermented or no under-fermented cocoa beans, no discolouration, and are well dried beans while Grade B cocoa are those with little impurities, little non-fermented or little under-fermented cocoa beans. The Grade B cocoa beans are inferior to the Grade A and are not well accepted in the international market. Marketers tell cocoa farmers that their products falls into Grade B and cannot be sold at the same price as the Grade A. This can be solved if Nigerian cocoa farmers can join the Fair-trade organisation (FTO) just as cocoa farmers in Ghana and Cameroon have. These two countries are among the 11 members of FTO; its members enjoy US\$150 per tonne as a fair-trade premium, resulting in the reduction or elimination of price fluctuation and facilitating conventional cocoa production as well

as organic cocoa production. Similarly, in Benin, the Dutch/Benin Integrated Development Project (PADEC-Kandi) has also solved the problem of price fluctuation in organic cotton production as the programme offers a grant of fixed market price in advance to organic cotton farmers. The Benin organic cotton farmers were paid 20% above the local seed cotton price. The adoption of the above solutions in Nigeria would favour conventional as well as organic cocoa production in the country.

6.1.2 Constraints of Production of Organic Cocoa

As mentioned in the literature review, certification is a major constraint of organic production especially in developing countries. High certification cost is not the only issue of certification as there is also the process of certification itself as well as dealing with the certification bodies. Farmers in developing countries have little or no information about the certification process and the certification bodies. They do not know which of the certification bodies is more efficient, reputable and reliable. Since there is no organic production in Nigeria, potential Nigerian organic cocoa farmers should get their product certified by the Soil Association or other recognised European certifiers as they will be exporting to Europe. For instance in Ghana and Cameroon, these countries are in partnership with European certification bodies, thus allowing Ghanaian and Cameroon organic cocoa to gain access and free movement within European Union as products certified by any one EU member can circulate freely within the EU. Also in Belize, the organic cocoa farmers worked with Green and Black (an UK organic company) who ensure that their partner farmers' farms are certified and inspect annual by the Soil Association, the UK leading certification body. Thus, the Nigerian organic cocoa should adopt this approach.

Likewise the problem of high certification cost can also be solved as has been done in Ghana whereby the certification body and the farmers worked out a percentage of the cocoa premium that goes to the certification bodies. Also, in Belize, Green and Black Organic trade directly with some Mayan cocoa farmers and these organic cocoa farmers are paid premium and fair-trade price making it easy for the farmers to pay for certification. Hence, if Nigerian cocoa farmers can adopt these methods organic cocoa production will be viable in Nigeria.

From the literature review, conversion period is a vital concept in organic farming but this is also a major constraint of organic agriculture in Nigeria. Nigerian cocoa farmers see conversion period as an avenue to lose income as their product will not be certified organic during the period. Certification bodies should give detailed information for organic management prior to the first inspection, like letting the farmers know that they can sell their products from the conversion period as conventional products and not as organic products, this will make the farmers happy as they are not losing any income and most likely gain additional income from the reduction in production cost as money that is supposed to be used for agro-chemical is now add to their income. To solve this problem, Nigerian organic cocoa farmers should be allow to do similar thing as in Ghana where existing conventional cocoa farms are allow to be converted to organic within the 3 years conversion period and during the conversion period effective organic production principles are carried out without the farmers necessarily starting new cocoa farms. Hence, this should be encouraged in Nigeria.

Inadequate information on organic farming is another problem. Government, research and related tertiary institution should organise conferences and seminars to enlighten farmers on the principles of organic farming. For example, the effect of OAPTIN is being felt in Nigeria through its annual conference and the offering of organic courses in Nigerian institutions.

In respect of all the aspects discussed above, it is important to state that organic cocoa production may encounter the same constraints as conventional cocoa production in addition to the mentioned specific organic cocoa production constraints. But this should not be a hindrance as Ghanaian organic cocoa production experienced the same problems and were able to succeed by putting into place necessary solution to the problems as well as effective practising of organic principles.

Also, continual researching of different organic production methods by relevant research institutions and farmers as well as the adoption of these new innovations by Ghanaian organic cocoa farmers have made Ghanaian organic cocoa a success story. Hence, organic cocoa production is feasible and viable in Nigeria if the various relevant organic production methods used by neighbouring countries, especially Ghana, are adopted.

6.1.3 Nigerian Cocoa Farmers' Willingness to Adopt Organic Cocoa Production

From the result of this study, few farmers (6%) said that they are not willing to adopt organic cocoa production in spite of their awareness that organic farming is similar to the traditional way of production. They do not believe that agriculture is possible in

Nigeria without the use of agro-chemicals as they have experienced the benefit of using agro-chemicals. These farmers are of the opinion that the current climate change may not encourage organic production due to their belief that those traditional methods practised in the olden days may not be relevant to the recent climate change, insect pests and diseases. Meanwhile, the majority (94%) of the interviewed cocoa farmers are willing to go into organic cocoa production provided relevant information and assistance are made available to them. They are of the opinions that every new innovation is a risk but are optimistic about organic agriculture as it is similar to the traditional way of production with which they are familiar and they are ready to take the risk. From this, it is therefore expedient that motivation should be given to these farmers by the government by making policy that supports organic production such as giving incentives to organic farmers as done in the developed countries.

6.1.4 Method of Weed Control

From Figure 4.8, surprisingly, hand-weeding was found to facilitate high yield in Nigerian cocoa production as against other method of weed control. Despite, hand weeding's high demands for labour, results of this study show that most of the interviewed cocoa farmers (78%) employed only hand weeding to control weed while 12% of the farmers used both hand weeding and herbicides. This shows that hand-weeding as a weed control method can not be underestimated in cocoa production. This may be as a result of high cost of herbicides as farmers believe hand weeding their farmland is relatively cheaper than applying herbicides on their farmland and also saves them the stress of sourcing these agro-chemicals, which are not readily available to them. Employing hand weeding on their farm reduces their production costs. Hand weeding as a weed control method facilitates easy adoption of organic cocoa production in Nigeria. Hence, cutlasses, machetes and hoes used in hand

weeding should be readily available for the farmers at a cheaper rate. Making more of these tools will also generate employment as well as increasing the income of the producers of these tools. Government can encourage cocoa farmers and indirectly organic cocoa production by lending or giving out these tools to farmers.

6.1.5 Research Methodology

This study employed the use of a questionnaire, attending the annual national conference of National Cocoa Development Committee, visits and discussion with relevant organisation like OOCORD, CDUs and field survey to obtained data which were then use to determine the economic feasibility of production and marketing of organic cocoa in south–western Nigeria. This study employed these methods resulting from the finding of Robson (2002) that concluded that combined use of questionnaire and field survey produced qualitative and quantitative data for effective results.

Purposive and multi-stage sampling techniques were employed in the study in order to sample relevant farmers within the time frame of the field survey. Similarly the sample size was limited to 100 farmers and the study area limited to the south-western part of Nigeria due to the time and financial constraints of this study. This study chose south-western Nigeria as it comprises almost all the major cocoa producing states in the country. Also, no one has ever researched this subject matter in Nigeria as whole; hence it was advisable the research should be done in an area familiar to the researcher and at a relatively small scale to avoid ambiguity. However, further studies can increase the sample size and also use all the fourteen cocoa producing states as the study area. This study will serve as a guide and also provide useful and relevant information for similar studies. This study will also make it easier for future research

on organic cocoa farming in Nigeria to concentrate on the south-western part of Nigeria having given broad pictures of cocoa farmers willingness to adopt organic cocoa production as no evidence of the willingness of cocoa farmers in the other part of the country have been identified.

Gross margin was used in the study in order to obtain detailed information about the economics of organic cocoa production. Lack of record keeping by farmers made it difficult for the research to get information on fixed costs (cost of land, cost of heavy farm machineries) which are needed in calculating net margin.

6.1.6 Profitability of Potential Organic Cocoa Production in South-Western Nigeria

This study confirmed that organic cocoa production in south-western Nigeria is not only economically feasible but also potentially profitable. Using different organic cocoa price from neighbouring countries like Ghana and Ivory Coast, and from Uganda, organic cocoa will be more profitable in Nigeria than conventional cocoa production. At different organic premium levels yield and labour cost, organic cocoa production was found to be profitable. This study also suggests that organic cocoa production could improve the standard of living of Nigerian cocoa farmers.

6.2 Conclusions

From the results of this study, pest and disease infestation is a major problem encountered by the cocoa farmers, but this cannot still hinder the adoption of organic cocoa in Nigeria as organic ways of controlling these are available and new ways are being developed.

Hand weeding was found to be effective in producing high yield among the various methods of weed control thus favouring organic cocoa production in the South-western Nigeria.

Organic cocoa production was found to have a higher gross income with lower variable cost in the study area. Thus it can be concluded that organic cocoa production is economically feasible in Nigeria. Likewise, the successful practice of organic cocoa production in Ghana also provides supporting evidence as Nigeria and Ghana are in the same geographical zone, thus enhancing the conclusion that organic cocoa production is possible in Nigeria. Thus, farmers in the study can have a better and improved standard of living when they adopt organic coca production.

6.3 Recommendations

Developed countries especially USA and UK are known to be funding agricultural projects in developing countries (such as the Structural Adjustment Programme in the 1990s in Nigeria) hence this can to transfer to organic production by promoting and developing research in Nigerian organic cocoa production.

Certification of Nigeria organic cocoa should be done in partnership with international certification bodies. For instance, in Ghana, the local production company (Ghana Oil Palm Development Company (GOPDC) was in partnership with Ecocert whereby Ecocert certified Ghanaian oil palm, organic pineapple, mango, banana, herbs and small amounts of its vegetables. A similar scenario is seen in Cameroon, where the Association for the Promotion of Organic Agriculture (ASPABIC) gets their products certified by Ecocert.

NGOs that promote ecological and fair-trade principles should be set up in Nigeria similar to Ghana where Ecotrader (which comprises 15 Ghanaian NGOs) see to the promotion of ecological and fair-trade. The setting up of an umbrella NGOs would make it easier to work with international organisations. For instance, the Ghana Organic Agriculture Network (GOAN) worked with Garden Organic, formerly HDRA and PAN-UK in carrying out a range of organic projects.

Farmers can form groups or associations where technical know-how and relevant organic production matters are carried out. Several of these associations have been formed in Ghana such as the Traditional Organic Farmers Association (TOFA) and the Ecumenical Association for Sustainable Agriculture and Rural Development (ECASARD). These farmers' associations can be a member of international associations just as TOFA is an IFOAM member

International manufacturing industries can be involved in Nigerian organic cocoa production as is done in many developed countries. For instance, Green and Black Organic Company (a UK organic company) worked with cocoa farmers in Belize. This company arranges certification by the Soil Association. Similarly, the organic products manufacturers from the developed countries can work with CRIN, the body that over see matters relating to cocoa production in Nigeria. As in Ghana, the Organic Commodity Products (OCP) entered into a contract with Cocoa Research Institute in Ghana (CRIG) whereby CRIG develops alternative organic solutions to disease and pest control, and soil fertility and OCP funds the research. This has been a big success as CRIG did a research in controlling capsids using crude neem seed extract with TOFA, one of the associations of local organic cocoa farmers.

The adoption of organic should start off with a small group in Nigeria and can then be extent to larger groups once it is well established as the allows for easy co-ordination and dissemination of organic cocoa production principles. In Ghana for instance, TOFA was first to start organic cocoa production before the production was extended to other associations.

6.4 Suggestions for further work

Several areas of further research are required including

1 How Nigerian organic cocoa farmers can access the international organic market: studies should research how Nigeria organic cocoa can penetrate organic market as this study and other studies have reported that there is large market for organic products especially organic cocoa. Ways in which Nigerian organic cocoa can be promoted and advertised, as well as packaging of the products should be studied in order to gain access and acceptability in the global organic market

2 Alternative organic production methods that would require less labour; research should be done on different organic production methods for planting, harvesting, post-harvest handling, processing, and packaging that require less labour. Also, organic production methods that require less labour practised in neighbouring countries such as Ghana should be tested and adopted.

3 Identify more production variables of organic farming: studies that determine other important organic production variables should be carried out. Studies that estimate the fixed cost, net income, profit/ loss ratio of organic farming especially organic cocoa should be done as this will give broader information on the economics of organic cocoa.

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APPENDIX

QUESTIONNAIRE

ECONOMIC FEASIBILITY OF PRODUCTION AND EXPORT OF ORGANIC COCOA IN SOUTH- WESTERN, NIGERIA.

Dear respondent,

I am a research student from the department of Sustainable Agriculture, Faculty of Business, Environment and Society, Coventry University, United Kingdom. In partially fulfilment of my programme, I am collecting the following data. I promise that any information provided would be treated under confidentiality and for academic purpose only.

- (1) LOCATION OF FARM :
- (2) SEX : MALE () FEMALE ()
- (3) AGE (YRS) :
- (4) FARM SIZE (Ha) :
- (5) FARMING EXPERIENCE :
- (6) LEVEL OF EDUCATION (YRS) :
- (7) PLANT POPULATION/HA (kg/Ha) :
- (8) YIELD (kg/Ha) :
- (9) YIELD PRICE (kg/N) :
- (10) PLEASES INDICATE THE FARM OPERATION PRACTICED
WEEDING () FERTILIZER APPLICATION () MULCHING ()
INSECT CONTROL () HARVESTING () OTHERS (Specify) -----
- (11) WHAT IS THE LABOUR COST OF THE ABOVE FARM OPERATIONS?
WEEDING ----- FERTILIZER APPLICATION -----
MULCHING ----- INSECT CONTROL----- HARVESTING -----
OTHERS (Specify) -----
- (12) How do you control weeds? Herbicides (use of chemicals/spraying) () Hand weeding (hoe/cutlass) ()
- (13) If herbicides, what type, quantity and cost? Gramoxone-----
Round up-----

Touch down-----

Others-----

(14) How do you control insects? By Insecticides () other methods ()

(15) If other methods (e.g yellow ant), please specify-----

(16) If insecticides, what type, quantity and cost? Basudin-----

Capsitox 20-----

Diazex 60 EC-----

Others-----

(17) What fungicide do you use for the control of cocoa disease? Chemical () other methods ()

(18) If fungicides, what type, quantity and cost? Ridomil plus 72-----

Copper oxide-----

Pereniox-----

Lime bodaus mixture-----

Others-----

(19) Source of finance: Personal saving () Bank loans () other source ()
specify-----

(20) How do you get your farmland? (a) Purchased () (b) Lease () (c)
inherited () (d) rented () (e) Government ()

(21) Price of the farm land-----

(22) Type of farming system: mono-cropping () mixed cropping ()

(22b) When it is mixed, what crop do you cultivate with? -----

(23) Please state the variable cost (labour/materials) incurred in production:

(a) Cost of planting material

(b) Harvesting

(c) Carrying pod out of the farm

(c) De-podding

(e) Sun-drying

(f) Security

(g) Fermentation

(h) Sorting

(i) Fermentation

(g) Please specify other variable costs not mentioned above-----

(24) Please state other fixed cost of production

(a) Bags/sacks-----

(b) Storage house-----

(c) Spraying pump-----

(d) Permanent structure-----

(25) Do you carry out any processing on your cocoa produce Yes () No ()

(26) If Yes, what process do you carry out: fermentation () Sun-drying () others specify-----

(27) Please specify the method of fermentation. (a) Basket () (b) Heap () (c) Tray () (d) Sweat box () (e) Others () specify-----

(28) How do you pack your produce? (a) Jute bag () (b) Polythene bag () (c) Synthetic bag () other () specify-----

(29) How do you store your produce? (a) Ordinary store () (b) licensed store () (c) Fumigated store () others () specify-----

(30) How do you transport your produce? (a) By head () (b) Vehicle () others () specify-----

(31) Is Cocoa farming your main source of income? Yes () No ()

(32) If No, specify (a) -----

(b)-----

(c)-----

(33) Do you experience any change in the price of your produce? Yes () No ()

(34) If yes, what are the price changes over the past years?

1 year ago-----

2 years ago-----

3 years ago-----

4 years ago-----

5 years ago-----

(35) Do you experience any problem in production and marketing of this produce? Yes () No ()

(36) If yes, please state the problem (a) Collection of seedling () (b) acquisition of farmland (c) Labour cost (d) Other () specify-----

(37) How do you market your produce? (a) Co-operative () (b) Licensed buying agent () (c) Self () Others () Specify-----

(38) How do you export your product?

Self () Co-operative () Government () Private Firm ()

(39) If not self export, do you encounter any problem in selling your products: Yes ()

No ()

(40) If yes, specify

a-----

b-----

c-----

d-----

e-----

(41) Apart from exportation of cocoa is there any other way of utilizing this product locally? Yes () No ()

(42) Please state-----

(43) Are you aware of organic production? Yes () No ()

(44) If yes, how and when do you know about organic agriculture?

(45) Do you apply fertilizer to your cocoa farm? Yes () No ()

(46) Which type of fertilizer do you apply (a) Organic () (b) Inorganic (mineral fert.)()

(47) If inorganic, what type, quantity and cost? (a) NPK () (b) Urea () (c) sulphate of ammonia () (d) Others () Specify-----

(43) Do you want to go in to organic production of cocoa: Yes () No ()

(44) If Yes, state reasons

a-----

b-----

c-----

d-----

e-----

(45) If No, state reasons

a-----

b-----

c-----

d-----

e-----

(46) If there any organic association? Yes () No ()

(47) If there is an organic establishment in future that train farmers on organic farming will you join? Yes () No ()

(48) IF Yes, state reason

(a)-----

(b)-----

(c)-----

(d) -----

